THE UNIVERSITY OF ALBERTA

THE MEASUREMENT OF ATTENTION DEFICITS IN MILDLY MENTALLY HANDICAPPED ADOLESCENTS

BY

J. LOUISE MELNYK

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

SPRING, 1988

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ISBN 0-315-42933-X

University of Alberta
Edmonton

Developmental Disabilities Centre

Canada T6G 2G5

6-123D Education North, Telephone (403) 432-4505

25th April, 1988

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J. Louise Melnyk has my permission to use *The Attention Check List* taken from my *Attention Activation Questionnaire* (1986) for inclusion in her Master's thesis, "The Measurement of Attention Deficits in Mildly Mentally Handicapped Adolescents".

J. P. Das

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DEGREE: MASTER OF EDUCATION

YEAR THIS DEGREE GRANTED: SPRING, 1988

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J. Louise Melnyk

3604 - 118 Street

Edmonton, Alberta

T6J 1W5

Date: April 27, 1988

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled "The Measurement of Attention Deficits in Mildly Mentally Handicapped Adolescents", submitted by J. Louise Melnyk in partial fulfillment of the requirements for the degree of Master of Education.

D.W. Fitzsimmons

Supervisor

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Date: Feb. 12, 1988

DEDICATION

In loving memory of my father, John William Melnyk.

ABSTRACT

The current research was undertaken to discern (1) whether the Abbreviated Conners Rating Scale (ACRS) and the Attention Checklist (ACL) would be appropriate instruments in the assessment of Attention-deficit Hyperactivity Disorder (ADHD) with the mildly mentally handicapped; and (2) whether teacher ratings of classroom behavior indexed by the ACRS and ACL were related to performance on objective measures of attention. These measures were vigilance and selective attention. Two studies were conducted.

In Study One, teachers of 100 familial mildly mentally handicapped adolescents completed ratings on the ACRS and ACL. Factor analytic results showed that the two scales loaded on a major factor that was attention. The scales were highly correlated.

In Study Two, mildly mentally handicapped adolescents designated as Good Attenders (n = 13) and Poor Attenders (n = 13) based on the ACRS and ACL ratings in Study One were administered sustained and selective attention tasks. The results based on analysis of variance showed that the sustained attention task did not discriminate the Good Attenders from the Poor Attenders but that the selective attention task did differentiate between the groups.

In general, this research points to evidence that the ACRS and ACL can be appropriately used with the mildly mentally handicapped in the assessment of ADHD. Furthermore, the findings suggest that the ACRS and the ACL are effective in assessing attention deficits in the mentally handicapped, particularly deficits in selective attention.

ACKNOWLEDGEMENTS

I wish to express my appreciation to my supervisor Dr. J. P. Das for his guidance, direction, and unfailing support throughout this project. I am indebted to Dr. C. K. Varnhagen who contributed so enormously to the successful completion of my thesis. Special thanks for so generously sharing her knowledge and expertise and for her patience, encouragement, and enthusiasm. I am also grateful to Dr. G. W. Fitzsimmons whose wisdom and valuable insights added richly to my graduate program.

The staff and students of L. Y. Cairns High School played a vital role in this project. I would like to extend my thanks to them for their interest and willing participation. Special gratitude goes to Mr. Wm. Rollans, school principal, for his commitment to education and his support of this endeavour.

Finally, I would like to thank my mother, Pearl Melnyk, for her encouragement and loving support, always.

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CHAPTER 1

Introduction

The Nature of the Problem

Attention-deficit Hyperactivity Disorder (ADHD) (DSM III-R, 1987) is one of the most common disorders of childhood (Barkeley, 1987; Loney, 1985). This developmental disability follows a course of onset in infancy and early childhood to persist into adulthood (Campbell, 1985; Kerasotes & Walker, 1983). The primary characteristics of ADHD are inattention, overactivity, and impulsivity. It is, however, in the associated problems that the complex and detrimental nature of the disorder is exemplified. Individuals with ADHD frequently have problems in the academic, social, and emotional domains of their lives. Poor school achievement, poor family and peer relationships, low self-esteem, and conduct problems are listed among the common concomitants (Barkeley, 1987; Ross & Ross, 1982; Whalen & Henker, 1985). Fortunately, efforts in remediational research have received increasing emphasis and a number of effective pharmacologic, behavioral, and cognitive training treatment programs are available (Abikoff, 1985; Kendall & Braswell, 1982; Loney, 1986). The identification of individuals with ADHD is important, then, if remedial services are to be delivered.

ADHD and Mental Handicaps: Prevalence Data

One group of children in which ADHD may be a significant problem is the mildly mentally handicapped (MMH). In the Diagnostic and

Statistical Manual of Mental Disorders III (DSM III) (APA, 1980), it is stated that mild mental retardation may be a predisposing factor to the disorder. The more recent DSM III-R (APA, 1987) does not specifically make reference to mental handicaps in the ADHD classification but does account for this population by defining ADHD behavior as a function of mental age. Although evidence from pharmacologic studies (Gadow, 1981) and from surveys of social and health care workers (Eyman & Call, 1977) does suggest that mental handicaps and hyperactivity frequently occur together, prevalence estimates of ADHD among the mentally retarded are not available.

Prevalence estimates of ADHD in the overall population are generally accepted to range between 3-5% although estimates have varied from less than 2% of school-age children to as high as 20% (Barkeley, 1981; 1987). There are several reasons for this disparity in figures but foremost are the definitional and diagnostic difficulties associated with the disorder.

There appears to be considerable uncertainty as to how best to define ADHD. During the past three decades, the status of the disorder has changed in conceptualization. The course of change involved regarding ADHD as a central nervous system dysfunction, then a minimal brain dysfunction, then a hyperkinetic reaction, and finally a cognitive processing deficit in attention (Ross & Ross, 1982). Accompanying these changes has been continued reformulation of the terminology and nosology used to describe it. Thus, the prevalence estimates necessarily vary as a function of the definition and

diagnostic criteria applied.

The prevalence issue is further complicated by the unspecific nature of diagnostic criteria for ADHD. The behaviors that make up the ADHD diagnostic constellation represent not uncommon childhood behaviors and, as such, fail to provide definitive positive markers for diagnosis (Ross & Ross, 1982). The symptomology presents erratically, varying across time, setting, and situation (Campbell, 1985). Furthermore there is considerable overlap in the presenting symptoms between ADHD and other conditions like conduct disorder and learning disabilities (Cantwell & Baker, 1987; Tarnowski, Prinz, & Nay, 1986). Therefore, even when applying the same criteria, there is a wide margin for variability among diagnosticians.

Rating Scales for ADHD

How, then, can ADHD children be distinguished from other children? Rating scales completed by teachers and parents have proved an invaluable tool in the assessment of ADHD by providing a statistical approach to identification (Barkeley, 1981; 1987; Trites, 1978). These instruments offer a means to structure behavioral observations, quantify behaviors, and differentiate extreme from normal behavior (Edelbrock & Rancurello, 1985). In applying this approach, a child scoring at least two standard deviations above the mean of normal children is considered ADHD.

The Abbreviated Conners Rating Scale (ACRS) (Conners, 1973), also known as the Hyperkinetic Index of the Conners Teacher Rating Scale (Conners, 1969), is perhaps the most commonly used instrument for both

research and clinical purposes pertaining to ADHD (Barkeley, 1981; Brown, 1986). In studies with non-retarded children, the scale has been found to be an efficient primary screening device for ADHD (Satin, Winsberg, Monetti, Sverd, & Foss, 1985). It has been shown to reliably distinguish ADHD children from normal children (Conners, 1973; Werry, Sprague, & Cohen, 1975) and to further distinguish ADHD children from other clinical populations (Kuehne, Kehle, & McMahon, 1987). Extensive norming data is available on the instrument (Goyette, Conners, & Ulrich, 1978; Werry, Sprague, & Cohen, 1975) and good validity and reliability have been demonstrated (Epstein & Nieminen, 1983; Zentall & Barack, 1979). No research is available on its use with the mentally handicapped.

Concerns have been expressed that the ACRS focuses on primarily the hyperactive aspects of ADHD rather than the attention component (Ross & Ross, 1982; Ullman, Sleator, & Sprague, 1985). One study of the factorial structure of the ACRS has yielded some support for this position (Brown, 1986). Only two of the scale's ten items were found to load on an attention factor. Because attention deficits are now recognized as a central and persistent feature of the disorder, the adequacy of the ACRS in assessing attention is important.

The present study was designed to make a contribution to the validity of rating scales in attention assessment through criterion-related validation. Criterion-related validity "compares test scores, or predictions made from them with an external variable (criterion) considered to provide a direct measure of the

characteristics or behavior in question" (Cronbach, 1971, p. 444). Two external criterion measures were used in this research. First, the ACRS was compared to another teacher rating scale, the Attention Checklist (ACL) (Das, 1986b) which was designed specifically to assess attention through behavioral observations. Second, the teacher ratings of MMH adolescents on the ACRS and the ACL were compared to subject performance on objective measures of attention. The attention measures administered were selective and sustained attention tasks.

Statement of the Problem

This research was designed to serve two objectives. First, the ACRS was examined as an instrument which would be appropriate for use with the mildly mentally handicapped (MMH). Specifically, the prevalence of ADHD in a sample of MMH adolescents and the factor structure of the scale derived from teacher ratings of this special population were investigated. The second objective was to test the validity of the ACRS in the assessment of the attention of MMH adolescents. Two types of criterion-related validity were studied: (1) concurrent, by comparing ratings on the ACRS to those of another rating scale, the Attention Checklist (ACL); and (2) external, by comparing children's ACRS ratings to their performance on sustained and selective attention tasks.

In the present project the heterogeneity of the mentally retarded population is acknowledged by following Zigler and Hodapp's (1986) distinction between organic and familial types of mental retardation. Organic retardation involves defects caused by inborn or prenatal

factors. Familial retardation has no known organic defects and is thought to represent the lower extreme of the normal distribution curve of intelligence. Because organic damage has previously been cited as an exclusionary criterion in ADHD (DSM II, 1968), the current research has limited its MMH sample to the familial mildly mentally handicapped.

Hypotheses

(1) It was predicted that the prevalence of ADHD among the familial mildly mentally handicapped would not differ significantly from that in the general population.

(2) The factor structure of the ACRS in this study sample was expected not to differ from that generated from data on non-retarded groups. These expectations were based on the assumption that the familial MMH, representing the lower end of the normal distribution of the population, are more alike than different from the non-retarded population and should, therefore, be rated similarly on the ACRS.

(3) The ACRS was expected to correlate well with the ACL.

(4) MMH adolescents identified as Good Attenders based on ACRS and ACL ratings were expected to perform significantly better on sustained and selective attention tasks than MMH adolescents identified as Poor Attenders by the ratings.

Definitions

Attention-deficit Hyperactivity Disorder

Attention-deficit Hyperactivity Disorder (ADHD) is used as an umbrella term to subsume all previous labels applied to the disorder.

These past labels include hyperactivity, hyperkinetic reaction of childhood and Attention Deficit Disorder. ADHD is understood to be a symptom cluster characterized by inattention, impulsivity, and hyperactivity.

Hyperactivity

Hyperactivity refers to "qualitative or quantitative aspects of motor activity, such as excess motor activity or situation specific motor activity" (Cantwell & Baker, 1987, p. 159).

Sustained Attention

As defined by Warm (1984), sustained attention is "the ability of observers to maintain their focus of attention and to remain alert to stimuli over prolonged periods of time" (p. 4).

Selective Attention

As defined by Posner and Boies (1971), selective attention is "the ability to select information from one source or of one kind rather than another" (p. 371).

Mildly mentally handicapped

Mildly mentally handicapped (MMH) is defined as "significantly subaverage general intellectual functioning existing concurrently with deficits in adaptive behavior and manifested during the developmental period" (Grossman, 1983, p. 11).

Overview of the Chapters

A literature review focusing on two areas relevant to this research is presented in Chapter 2 where attention deficits with respect to ADHD and mental retardation and rating scales of ADHD will

be covered. As this project involved two studies, Chapters 3 and 4 are devoted to their discussion. The first study which investigated the application of the ACRS and the ACL to a MMH population is discussed in Chapter 3. The second study which tested the external validity of the ACRS and the ACL is covered in Chapter 4. Chapter 5 presents a discussion of the research findings and suggestions for further research.

CHAPTER 2

Selective Review of the Literature

This literature review is divided into two sections. The first section addresses attention deficits as relevant to Attention-deficit Hyperactivity Disorder (ADHD). A discussion of the nature of attention deficits will be followed by the current diagnostic criteria for ADHD. Then, studies investigating the nature of the sustained and selective attention deficits in non-retarded ADHD children will be reviewed taking into account the diversity of the tasks used. The comprehensive review of attention deficits in ADHD children compiled by Douglas and her colleagues (Douglas, 1983; Douglas & Peters, 1979) will serve as the framework for this presentation. Finally, this section will cover research into attention deficits in the mentally handicapped because research and theory have been less than clear as to whether attention deficits are characteristic of this population.

The second section of the literature review will present an overview of rating scales as an assessment instrument of ADHD. Special emphasis will be placed on the Abbreviated Conners Rating Scale.

Attention Deficits

The disorder now known as "Attention-deficit Hyperactivity Disorder" (ADHD) has only recently been viewed as a cognitive processing deficit. In its historical evolution the status of the disorder has changed from a medical problem linked to some form of brain damage to a behavioral problem stemming from excessive motor

activity to its current description as a cognitive disorder involving attention (Ross & Ross, 1982). For the past decade there has been increasing importance assigned to the attention deficit component of the cluster of behaviors considered characteristic of ADHD. Attention deficits have become recognized as a primary underlying disability for ADHD children (Douglas, 1983) and as the most persistent feature of the ADHD symptom complex (DSM III, 1980; Edelbrock, 1985).

Nature of Attentional Deficit

What, then, is the specific nature of the problems in attentional performance experienced by ADHD children? The imprecise and amorphous use of the concept of attention has greatly hindered efforts to clarify this issue. As Moray (1969) has pointed out "attention is a word with many varied meanings applicable to a very wide range of phenomena" (p. 5). Moray has instead suggested seven individual attentional processes including vigilance, selective attention, concentration, set, search, activation, and analysis-by-synthesis. The complexity of the attentional concept is supported by Posner and Boies (1971) who have identified three major subdivisions: "(1) alertness, or the ability to maintain optimal sensitivity to external stimuli; (2) selection, or the ability to concentrate awareness upon one source of information rather than another; and (3) limited processing capacity" (Warm, 1984, p. 2). Thus, with the multifaceted nature of the concept of attention it is easily understood why there is little consensus on how to define an attention deficit.

The two aspects of attention that have received the greatest

treatment in ADHD literature, however, have been sustained and selective attention (Douglas, 1983; Douglas & Peters, 1979). Sustained attention in ADHD research is closely associated with Posner and Boies' alertness component but more specifically refers to the maintenance of alertness to stimuli over prolonged periods of time (Warm, 1984). Selective attention aligns with their selection component but has been further refined to refer to the "ability to focus on critical target stimuli while 'ignoring' non-target stimuli" (Douglas, 1983, p. 286).

Researchers studying the sustained and selective attention processes of ADHD children have generally looked for differences between this population and normal children. The tasks used to define these differences have shown considerable diversity in design. This lack of a single diagnostic test has led to ambiguous results and difficulties in interpretation with respect to attention deficits in ADHD children.

Clinical Features of ADHD

Definition and classification of the behavior disorder commonly referred to as "hyperactivity" has been a controversial issue as evidenced by the repeated reformulation of the disorder with each edition of the Diagnostic and Statistical Manual of Mental Disorders (APA, 1968; 1980; 1987). In the most recent edition (DSM III-R, 1987), another revision in terminology, classification, and diagnostic criteria has been offered. The disability is now termed "Attention-deficit Hyperactivity Disorder" and classified under the category "Disruptive Behavior Disorders."

The current operational criteria for the disability are contained in Table 1. The fourteen behaviors that make up the ADHD constellation are arranged in descending order of diagnostic power. Consistent with previous definitions, the three primary characteristics of the disorder have been maintained: each of the criteria listed is illustrative of either inattention, hyperactivity, or impulsivity. Although the revisions are not major alterations in the diagnostic criteria, new dimensions in diagnosis have been formulated. First, mental age has become an important element of diagnostic decisions. Decisions regarding whether a criterion is met are based on the frequency of the behavior in relation to others of the same mental age. Second, three levels of severity (mild, moderate and severe) have been delineated. Mild designation is indicated by only the minimum criteria being met and no or little academic and social dysfunction in evidence. Severe is appointed if there are many symptoms in excess of the minimal diagnostic criteria paired with significant dysfunction in the academic and social domains. Moderate is considered at an impairment level between the two extremes.

Research has not determined whether these revisions contribute to clarifying the definitional and diagnostic confusion pertaining to ADHD. It is noteworthy that this category was brought under revision to eliminate a subtype of the disorder (Attention Deficit Disorder without hyperactivity). Field studies have revealed that this subtype is rarely diagnosed (DSM III-R, 1987). The current changes were not the product of research rejecting the past definition or supporting the

Table 1

DSM III-R Diagnostic Criteria for Attention-deficit Hyperactivity Disorder

The diagnostic criteria for ADHD are the following:

A. A disturbance of at least six months during which at least eight of the following are present:

(1) often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness)

(2) has difficulty remaining seated when required to do so

(3) is easily distracted by extraneous stimuli

(4) has difficulty awaiting turn in games or-groups

(5) often blurts out answers to questions before they have been completed

(6) has difficulty following through on instructions from others (not due to oppositional behavior or failure of comprehension), e.g., fails to finish chores

(7) has difficulty sustaining attention in tasks or play activities

(8) often shifts from one uncompleted activity to another

(9) has difficulty playing quietly

(10) often talks excessively

(11) often interrupts or intrudes on others, e.g., butts into other children's games

Table 1 (cont.)

(12) often does not seem to listen to what is being said to him or her

(13) often loses things necessary for tasks or activities at school or at home (e.g., toys, pencils, books, assignments)

(14) often engages in physically dangerous activities without considering possible consequences (not for the purpose of thrill-seeking) e.g., runs into street without looking

B. Onset before the age of seven.

C. Does not meet the criteria for a Pervasive Developmental Disorder (DSM III-R, 1987, pp. 56-57).

current one, nor were they made in response to major theoretical changes in the understanding of the disorder (Snyder, 1987). Because these changes are not empirically based, it is difficult to predict their application in clinical practice.

Attention Studies with ADHD Children

Sustained Attention. A number of studies have investigated sustained attention in ADHD children. Of these, the majority have employed a Continuous Performance Test (CPT) format (Taylor, 1985). The CPT was originally designed to measure attention deficits in brain damaged patients (Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956). The test involved the visual presentation of single letters at a rate of about one per second over a ten minute period. The subject was required to detect a target stimulus (the letter "X" in one condition and "X" only when preceded by "A" in another) which was intermittently placed within a series of non-target letters.

Many variations of the CPT have since evolved, resulting from modifications to the task variables like stimulus type (numbers, geometric shapes, words), task length (3 to 30 minutes), interstimulus interval (0.5 to 2.0 seconds), modality of presentation (auditory and visual), and density of target events (3 to 15 per minute) (Warm & Berch, 1985). Nevertheless, the common task demands are alertness over an extended period of time, responding correctly to target events, and withholding responses to non-target events (Douglas, 1983). The failure to detect target signals (errors of omission) has served as a measure of attentiveness whereas the failure to withhold responses

(false alarms) has been used as evidence of impulsivity or disinhibition.

Research using a CPT format has generally supported a sustained attention deficit. Early studies by Sykes and his associates (Sykes, Douglas, & Morgenstern, 1973; Sykes, Douglas, Weiss, & Minde, 1971) found that ADHD children made fewer correct detections than normal controls on both visual and auditory versions of the CPT. The hypothesis that ADHD children are more impulsive than normals received mixed support. In their first study (Sykes et al, 1971), no difference between groups was shown in the number of false alarms whereas in the second (Sykes et al, 1973), the ADHD children committed a significantly greater number of errors of omission.

Other CPT studies with ADHD children have examined sustained attention applying the signal detection paradigm. Within this model, the subject is viewed as both a sensor and a decision maker (Warm & Berch, 1985). Two components of the response pattern are differentiated: (1) d', a measure of the subject's perceptual sensitivity to the target signal as compared to the background events; and (2) β, a measure of the observer's caution or bias in responding. The former is closely associated with attentiveness whereas the latter is concerned with impulsivity.

Of four studies applying signal detection theory, one investigation (O'Dougherty, Nuechterlein, & Drew, 1984) found the ADHD children to perform significantly poorer than normal children on visual CPT tasks in sensitivity to target signals (d') and response bias (β).

In two other studies using visual CPT tasks (Sostek, Buchsbaum, & Rapoport, 1980; Tarnowski, Prinz & Nay, 1986), ADHD subjects demonstrated significantly poorer sensitivity to targets but similar response bias when compared to a normal control group. However, Draeger, Prior, and Sanson (1986) failed to find group differences on either dimension using both auditory and visual formats of the CPT. Although the findings are mixed, these results suggest ADHD children to be less sensitive to the target signals (d') than normal children on sustained attention tasks. Caution in responding (β) does not appear to be a differentiating feature.

Reaction Time (RT) tasks have also been used to study sustained attention deficits in ADHD children. Similar to the CPT, RT tasks demand a long watch period and withholding of responses to neutral signals. However, rapid responding to target signals is an added dimension (Douglas, 1983). In two studies (Cohen & Douglas, 1972; Firestone & Douglas, 1975), a delayed RT task was employed in which a warning signal was presented prior to the target signal. The reaction time of the ADHD group was shown to be significantly longer and more variable than that of the control group in both investigations. Loiselle, Stamm, Maitinsky, and Whipple (1980) confirmed these results using a simple RT task with no pre-target signal. These researchers, as did Firestone and Douglas (1975), examined false detections in the response patterns and found ADHD subjects to commit a significantly greater number of errors of omission than control subjects.

In summary, research on sustained attention with ADHD subjects has

fairly consistently shown a deficit in the number of correct detections of target signals, sensitivity to target signals, and response times. The results, then, have rather robustly supported a deficit for ADHD children in their ability to remain alert to stimuli over prolonged periods. The measures used to assess impulsivity like false alarms and response bias have generally failed to provide consistent support for deficits in this area.

Selective Attention. Research into the selective attention processes of ADHD has been motivated by the repeated observation that children identified as ADHD appear more distractible than normal children. The studies within this attention area have generally employed one of three tasks: (1) extraneous stimuli distractors; (2) dichotic listening tasks; or (3) central-incidental learning tasks. Studies using each type of task will be discussed.

A number of investigators have examined the impact of extraneous stimuli on the performance of ADHD children. Their studies have employed a variety of school and laboratory target tasks and a wide range of distraction conditions. The distractors have included extraneous stimuli embedded in and external to the target tasks, and presented in the same and different modalities. In most cases, the findings have been that ADHD children are not affected by the presence of the distractors (Brewer & Stern, 1976; Sykes et al, 1971) or that, when distracted, the ADHD children are no more distracted than the normal children (Cohen & Douglas, 1972; Sykes et al, 1973).

Two studies (Radosh & Gittelman, 1981; Rosenthal & Allen, 1980)

have, however, demonstrated particular conditions under which greater distractibility has been displayed by ADHD children than by normal children. Rosenthal and Allen (1980) found ADHD children's performance on a speeded classification task to be significantly more affected in the expected direction than that of the control group when the extraneous stimuli were of high saliency value to the child. When the stimuli were of low value, there were no differences between groups. Radosh and Gittelman (1981) examined the effects of no, low and high appeal distractors on arithmetic performance and showed ADHD children to make more errors than normal children under the low and high appeal conditions. The authors speculated that the increased distractibility of the ADHD group in the presence of the low and high appeal distractors may have been a reaction to the repetitive and cognitively demanding nature of their target task. Thus, the studies using extraneous stimuli as distractors have failed to confirm the general hypothesis that ADHD children are more distractible than normal children although specific conditions like highly appealing distractors or dull, difficult tasks may elicit greater distractibility in this group.

Other researchers have utilized dichotic listening tasks to study selective attention in ADHD children. The dichotic listening tasks have involved the simultaneous presentation of different auditory stimuli to each ear via earphones. Task requirements have been either concurrent, where the subject is required to monitor all information from both ears, or selective, where the experimenter designates one ear

as the target to be monitored. Regardless of the requirements, the results using dichotic listening tasks have shown poor support for a selective attention deficit. Under concurrent conditions, Davidson and Prior (1978) and Hiscock, Kinsbourne, Caplan, and Swanson (1979) found no difference between ADHD and normal children. Under selective requirements, Davidson and Prior (1978) again found no difference between groups whereas Loiselle and his colleagues (1980) did find moderate deficiencies in their ADHD group with their results approaching significance. This disparity in findings under selective conditions is possibly attributed to the different levels of task demands. Davidson and Prior (1978) used a simple set of familiar words for targets whereas Loiselle and his associates (1980) employed tone pips closely related to non-target tones. As previously reported by Radosh and Gittelman (1981), cognitively demanding tasks may elicit greater distractibility in ADHD children. Thus, the difficult task demands in the latter study may account for the poor performance of the ADHD group.

Several experimenters have employed the Central-Incidental (C-I) Task paradigm (Maccoby & Hagen, 1965) to investigate selective attention deficits in ADHD children. The underlying principle of the C-I Task is that the acquisition of task irrelevant information should be minimal when attention is focused on task relevant information, there being a "trade off" between one and the other. In the C-I design, the subject is presented with a central task to focus on (e.g., remembering the serial order of animal cards). Unexpectedly at the end

of the central task performance, the subject is presented with an incidental task (e.g., remembering the name of objects that were paired with the central task). The central task performance is used as an index of focused attention, the incidental task performance as a measure of distractibility and attention diffuseness, and the relationship between the two as a measure of overall selective attention (Fleisher, Soodak, & Jelin, 1984).

The results of C-I Task studies with ADHD children have been mixed. Aman and Turbott (1986) found no evidence of selective attention deficits. Their ADHD subjects performed as well as the control group on central and incidental tasks. Consistent with these findings, Peters (cited in Douglas & Peters, 1979) also failed to find selective attention deficits. Utilizing an extended version of the C-I Task by including a non-distraction central task (central task alone), Peters found no performance difference between the distraction and non-distraction central tasks for the ADHD children. Furthermore, the ADHD group did not perform differently from the control group on the distraction, non-distraction, or incidental task. Tarnowski, Prinz, and Nay (1986), using the same C-I Task format as Peters, also showed ADHD children to perform similarly to normals on the non-distraction and incidental tasks. However, on the central task in the distractor condition, the ADHD children made significantly more errors than the control group. Tarnowski et al (1986) concluded that the ADHD group may have a greater susceptibility to distraction than non-ADHD children.

Ceci and Tishman (1984) conducted two studies of central-incidental learning with ADHD children using a different approach. In their first investigation, a number of cards with the target information (picture of animal) plus three gradients of incidental information (object directly associated with animal, object environmentally associated with animal, and background color) were presented to the subject. The central task was simply to remember as many animals as possible whereas the incidental task was to identify each of 120 stimulus cards as the same as or different from the original cards. The ADHD children were found to correctly reject significantly more "different" incidental information than the control group whereas both groups performed similarly on the recognition of target information. Ceci and Tishman (1984) concluded that the ADHD children appeared to process more incidental information without cost to the central task. Their second study was designed to examine the effect of task difficulty level on central-incidental processing. Two different methods were implemented to vary the cognitive demands of the task: in the first case, the processing time was limited by using a slow and a fast rate of target information presentation whereas in the second case the meaningfulness of the target information was varied by using high and low associative value abstract shapes. The results showed that ADHD children outperformed their normal peers in identifying incidental information when the task demands were easy (slow pace or high associative value). However, under difficult conditions (fast pace or low associative values), central and

incidental performance deteriorated for both groups but significantly more so for the ADHD children.

Ceci and Tishman's work has supported the hypothesis of the distractibility and attention diffuseness of the ADHD child. Furthermore, they have suggested that the cost of this distractibility is particularly evident in cognitively demanding situations. These conclusions offer an extension to the findings that tasks of greater cognitive load do influence the performance of ADHD children on measures of selective attention (Loiselle et al, 1980; Radosh & Gittelman, 1981).

In summary, there has been inconsistent support for a selective attention deficit in ADHD children. Studies employing extraneous stimuli and dichotic listening approaches have generally failed to show greater diffuseness and distractibility in ADHD children's attentional processes. C-I studies have generated conflicting results. However, there is mounting evidence that these deficits do not appear under simple task conditions. Rather, it appears that the greater distractibility of ADHD children is detectible when confronted with cognitively demanding tasks or particularly appealing distractors.

Attention Studies with the Mentally Retarded

Mentally retarded children have long been characterized as suffering from impaired attention. The early attention theories of Ellis (1963), and Zeaman and House (1963) pinpointed attention deficits as an important factor in the learning difficulties experienced by the mentally handicapped. Furthermore, neuropsychological support was

proffered in Luria's research (1963) linking poor selective attending to low arousal levels in the form of abnormal activation of the orienting response. However, subsequent research and theorizing has led to major restructuring of the aforementioned theoretical positions. Zeaman and House (1979), and Ellis (1970) have looked to other cognitive processes like memory and judgment, and memory strategies, respectively, as the major impediments to learning. Luria's work has been refuted in a series of experiments showing no evidence of an orienting response deficit in the mentally retarded (Das, 1978; Das & Bower, 1971). Consequently the status of attention processing in the mentally retarded has become less definitive.

Sustained Attention. Sustained attention studies with the mentally retarded (MR) have employed simple vigilance paradigms. In most cases, the subjects have monitored a light source and the critical signal has involved a specified change in the light pattern. Such changes have included an increase in light intensity, an interruption in a light beam, or the arrest of a blinking light. The general findings have been that: (1) adolescents and adults with mental handicaps do not differ significantly from normal chronological age (CA) controls (Kirby, Nettelbeck, & Bullock, 1978; Ware, Baker, & Sipowicz, 1962); and (2) MR preadolescents differ significantly in the expected direction from normal CA controls but perform similarly to normal mental age (MA) controls (Kirby, Nettelbeck, & Thomas, 1979; Semmel, 1965). Kirby and his associates (1979) have suggested that the deficit vigilance performance of the preadolescent MRs be attributed

to developmental factors in view of the comparable performance of MRs and normals in adolescence and adulthood.

Selective Attention. Several studies have investigated the selective attention processes of the mentally handiçapped taking into account the developmental level of the subjects. The tasks employed in these studies have included extraneous stimuli distractors and central-incidental learning tasks.

Researchers examining the effects of distracting stimuli on the performance of the mentally handicapped have failed to find a selective attention deficit. The performance of mentally handicapped children has been compared to that of their MA matched peers under a variety of auditory and visual distraction conditions. The results of these studies have indicated that the MR children are no more affected by extraneous stimuli than the normal MA group (Crosby, 1972; Forehand, Calhoun, Peed, & Yoder, 1973).

A small number of studies have been conducted with the mentally retarded using Central-Incidental learning tasks. These investigations, however, were originally designed to test whether MRs have deficits in incidental learning whereas the current central-incidental task theory relates incidental learning to distractibility. The three studies that follow are interpreted from the distractibility perspective.

An early study by Hetherington and Banta (1962) examined the performance of familially retarded, organically retarded, and MA-matched normal children on incidental and intentional (central)

tasks employing a memory for colored pictures test. The results showed no significant differences between the familially retarded group and the control group on either the intentional or incidental task. Both groups significantly outperformed the organically retarded group on both task measures.

Libkuman (1972) and Forehand et al (1973) in their studies of incidental learning in MRs, similarly, demonstrated no evidence of greater distractibility in the mentally retarded: there were no performance differences between the MR and the MA-matched control groups on incidental tasks. The two studies, however, present limitations in terms of a C-I Task interpretation. Libkuman (1972) failed to employ a measurable central task and Forehand et al (1973) used a central task that required demands other than focused attention. Nonetheless, the available information does suggest that the mentally retarded, and most particularly the familially mentally retarded, do not have selective attention deficits.

Summary

The review of the literature on attention deficits in ADHD and MR children has identified differences between the two groups. In ADHD, the research has robustly supported a sustained attention deficit, particularly when CPTs has been employed. In the mentally handicapped, there is little support for a sustained attention deficit.

The results are less clear in the case of selective attention. ADHD children have not been shown to demonstrate a pervasive selective attention deficit. On simple tasks, no deficit is apparent but on

more cognitively demanding tasks, selective attention appears to be problematic. With the mentally handicapped, there has been little evidence of selective attention deficits. As with ADHD children, on simple tasks, MRs do not appear to have deficits in this area when developmental level has been taken into account. However, efforts to test the influence of difficult task demands on selective attention with the mentally handicapped population are necessarily confounded because deficits in complex cognitive processing are a primary characteristic of mental retardation.

Rating Scales

Rating scales have become an indispensible tool in the assessment of ADHD (Edelbrock, & Rancurello, 1985). There are several reasons for their widespread application pertaining to ADHD in research and clinical practice. First, the nonspecific, variable nature of the ADHD symptomology lends itself to evaluation by rating scale. Clinicians have found that ADHD symptoms do not usually present in the clinical environment. It is in the child's natural environment at home and at school that the behaviors are more likely to be manifest. Therefore, parents and teachers provide invaluable diagnostic information regarding the frequency and severity of the child's behavior in these settings (Ross & Ross, 1982). Furthermore, the structured format of rating scales forces the observers to evaluate specific elements of a child's behavior rather than to describe behavior from a global perspective.

Second, rating scales serve as a vehicle for quantifying the ADHD

behaviors; a constellation of behaviors that are not uncommon to all children at some time. Through the standardization of the rating scales, criteria are established according to which decisions can be made as to whether the reported behaviors are deviant or within normal limits. Furthermore, by quantifying the behaviors, an index is established according to which change over time and in response to treatment can be monitored.

Finally, these instruments offer practical benefits. They are simple to use and are a cost and time efficient means of drawing information from a variety of settings and personnel.

Of the rating scales for ADHD, the scales designed for teacher report outnumber those for parents (Ross & Ross, 1982). It is stated in the DSM III (APA, 1980) that "when reports of teachers and parents conflict, primary consideration should be given to the teacher reports because of greater familiarity with age-appropriate norms. Symptoms typically worsen in situations that require self-application, as in the classroom" (p. 43). As reporters of behavior in the assessment of ADHD, teachers have been recognized as preferred and reliable sources (Brown, 1986; Rapoport & Ismond, 1984).

The Abbreviated Conners Rating Scale

The Abbreviated Conners Rating Scale (ACRS) (Conners, 1973) is perhaps the most commonly used teacher rating scale of ADHD (Brown, 1986). This scale was originally developed by C. K. Conners in 1973 to monitor treatment effects in pharmacotherapy with ADHD children and was derived from Conners' 39-item Teacher Rating Scale (CTRS) (Conners,

1969). Ten of the most frequently checked items of the CTRS were selected for this abbreviated version. These items are also known as the Hyperkinetic Index of the CTRS.

Although the ACRS was developed when hyperactivity was designated as the critical diagnostic feature of the disorder, the scale has continued in popular use despite continual changes in the conceptual status of ADHD. This popularity reflects the psychometric strengths of the instrument in ADHD assessment in terms of its validity, reliability, and standardization.

Evidence supporting the validity of the ACRS is substantial. The scale has been shown to effectively discriminate between ADHD and normal children (Conners, 1973; Satin, Winsberg, Monetti, Sverd, & Foss, 1985; Sprague & Sleator, 1973). In research testing the use of the ACRS as a primary screening device for ADHD, the scale identified 90% of clinically diagnosed ADHD cases one year after the original diagnosis (Satin et al, 1985). Additionally, a recent study by Kuehne, Kehle, and McMahon (1987) found that the ACRS discriminated between children with ADHD and children with Specific Learning Disabilities. In pharmacotherapeutic research, this instrument has been widely applied as a dependent measure in drug tests because of its proven sensitivity to drug therapy changes (Conners, 1973; Sprague & Sleator, 1973). Concurrent validity is supported by significant correlations with David's Hyperkinesis Index ($r = .844$) (Zentall & Barack, 1979) and the Conners Teacher Rating Scale ($r = .92$) (Werry, Sprague, & Cohen, 1975).

Good reliability has been established for the ACRS with teachers as reporters. An inter-rater reliability of .866 was reported between teachers (Epstein & Nieminen, 1983) and an intra-rater reliability of .890 was demonstrated in a two week between-ratings period (Zentall & Barack, 1979).

Extensive normative data have been produced in a number of studies (Goyette, Conners, & Ulrich, 1978; Ullmann, Sleator, & Sprague, 1985; Werry et al, 1975). Despite the availability of these data, the standard most frequently applied in clinical and research practice as indicative of ADHD is the overall mean score of 1.5 or greater. This cutoff score is two standard deviations above the overall mean score of normal children in the original norming study (Werry et al, 1975).

The ACRS has come under criticism since attention deficits have become recognized as the central feature of ADHD. Concerns have been expressed that, though the ACRS does effectively identify hyperactive behavior in children, it may fail to adequately assess attention problems (Ross & Ross, 1982; Ullmann et al, 1985.) A recent factor analytic study (Brown, 1986) has yielded support for these concerns. Of three factors derived, the factor designated as "attention" encompassed only two of the scale's ten items, and, of these two items (fails to finish things he starts, short attention span; and inattentive, easily distracted), the latter item also loaded moderately strongly on one of the other factors. In another study, Ullmann and his associates (1985) compared the ratings of normal and ADHD subjects on the ACRS to those on the Hyperactivity and Inattentive-Passive

factors of the CTRS. They found that the subjects scoring 1.5 or greater on the ACRS also scored high on the Hyperactivity factor. However, these subjects did not necessarily score high on the Inattentive-Passive factor. Furthermore, children scoring high on the Inattentive-Passive factor were not necessarily selected by the ACRS. They concluded that the ACRS did not effectively identify children with attention problems and went so far as to suggest that the ACRS be abandoned as an assessment instrument for ADHD. Thus, it does appear that the ACRS may have a weakness in the important area of attention assessment.

Summary

Rating scales have been shown to be an indispensible tool in the assessment of ADHD because of the variable, nonspecific nature of ADHD symptoms. Teachers are most often the preferred rating source. Of the teacher rating scales available, the Abbreviated Conners Rating Scale is most widely used but criticisms have been levied that the ACRS does not adequately assess attention problems.

CHAPTER 3

Study One

Validation of an Assessment Scale for ADHD with the Mildly Mentally Handicapped

Introduction

The Abbreviated Conners Rating Scale (ACRS) (Conners, 1973) is one of the most commonly used rating scales in research and clinical practice pertaining to ADHD. No research has been reported to date on the appropriateness of ACRS use with the mildly mentally handicapped (MMH) population. One of the objectives of this study was to examine the ACRS with familial MMH adolescents. Specifically, prevalence estimates of ADHD and the factor structure of the scale derived from teacher ratings of this special population were investigated.

Since attention deficits have been recognized as a central diagnostic feature of ADHD, the adequacy of the ACRS in the assessment of the attention component of this disorder has been questioned. The second objective of this study, then, was testing the concurrent validity of the ACRS in attention assessment by comparing it to the Attention Checklist (Das, 1986b). Correlation coefficients and factorial structures of the scales, individually and combined, were examined.

Method

Subjects

The subjects were 100 mildly mentally handicapped adolescents (54

males, 46 females) who attended a specialized junior/senior high school designed to meet the needs of the mildly mentally handicapped in a large urban centre. The sample was selected from the year 7-10 students (chronological age equivalent to Grade 7-10 in regular schools), drawn from 21 different homeroom classes.

Age, background, medical, and IQ information were obtained from cumulative files and medical records. The school nurse and audiologist also provided supplementary health and hearing information. Age and IQ data for the sample are provided in Table 2. Students were included in the study if the following criteria were met:

(1) There was no evidence of organic defects (e.g., Down Syndrome, brain damage) or hearing impairment;

(2) Intelligence assessment information was available;

(3) The student's full scale IQ did not fall below the arbitrary cutoff of 58; and

(4) The student was not on medication other than for the treatment of hyperactivity.

In subject selection, the hearing impaired were excluded because of the recognized relationship between hearing deficits and inattentive behavior (Sattler, 1975). A minimum IQ was imposed in an effort to restrict the sample to the familially retarded: organic defects have been inversely related to IQ in the mentally handicapped (Zigler, 1969).

Instruments

Abbreviated Conners Rating Scale (ACRS). The ACRS is a ten item

Table 2

Mean Age and WISC-R IQ for Males, Females and Total Sample for Study One

Group	n	Age (in years)		IQ	
		$\bar{x}$	SD	$\bar{x}$	SD
Males	54	14.5	1.2	71.7	8.6
Females	46	14.2	1.4	71.1	5.6
Total	100	14.4	1.3	71.4	7.3

rating scale composed of behavioral descriptions. The presence of a behavior is rated on a four-point scale as "not at all" (0), "just a little" (1), "pretty much" (2), and "very much" (3). The total score is calculated in the form of a mean score (total raw score divided by ten) and possible scores range from 0 to 3. The mean score of 1.5 or higher has become the standard applied as indicative of ADHD based on the original norming data's cut-off point of two standard deviations above the mean (Werry, Sprague & Cohen, 1975). The ACRS is presented in Appendix A.

The Attention Checklist (ACL). The ACL was developed by Das (1986b) in response to the need for a measure of children's attentiveness. On the 12-item scale, six questions are framed to represent attentive behavior and six to represent inattentive behavior. Questions are rated on a 4 point scale (scored 1-4) denoting whether the behavior is present ("not at all", "just a little", "pretty much", or "very much"). In scoring, the weight of the response is determined by whether the question is phrased in a negative or positive direction. With all items, the better the attention skills, the higher the score. Possible total scores range from 12 to 48. The ACL and its scoring key appear in Appendix B.

Procedure

Each subject was evaluated with the ACRS and ACL by one teacher who taught the designated student at least one academic class (reading, arithmetic, or human relations). Ratings were completed well into the school year (early March) to ensure teachers were familiar with the

students evaluated. A total of 15 teachers were selected to complete the rating scales. The mean number of student evaluations per teacher was 6.7 with a standard deviation of 3.9 and the range varied from 1 to 13.

The rating scales were filled out over a one week period. Each teacher was freed from regular teaching duties and provided with adequate, undisturbed time during the teaching day to complete the scales. Teachers were instructed to check the phrase that best described the student and to evaluate from a trait rather than state perspective. The average administration time was approximately ten minutes per evaluation. Teachers were not informed of the objectives of the project.

Results

ACRS and ACL Mean Scores and SDs

The mean scores and standard deviations on the ACRS and ACL are summarized in Table 3. The sample was subdivided by age and sex.

Group Differences

T-test statistics were used to compare groups by age, sex, sex within each age group, and age groups within each sex on the ACRS and ACL ratings. Overall, no significant group differences were recorded on either the ACRS or the ACL. However, differences between the older and younger females did approach significance ($t = 1.93$, $p < .06$). Similarly, differences between the older females and older males on the ACRS and the ACL approached significance ($t = 1.88$, $p < .067$ and $t = -1.70$, $p < .098$, respectively). In all cases, the older females

Table 3

Mean Scores on Abbreviated Conners Rating Scale (ACRS) and Attention Checklist (ACL)

			ACRS			ACL	
Age	Sex	N	$\bar{x}$ max.=3.0	SD	% 1.5 or more	$\bar{x}$ max.=48	SD
12-14 yrs	M	29	1.02	.97	31	33.4	10.9
	F	29	1.20	.90	31	33.1	8.7
	Both	57	1.11	.93	31	33.3	9.8
15-17 yrs	M	25	1.16	.75	48	31.2	8.6
	F	18	.76	.62	17	35.8	8.8
	Both	43	.99	.72	35	33.1	8.9
Total	M	54	1.08	.87	39	32.4	9.9
	F	46	1.03	.83	26	34.2	8.8
	Both	100	1.06	.84	33	33.2	9.4

Note. On the ACRS, the higher the score, the poorer the behavior rating. On the ACL, the converse is the case.

received better behavior ratings.

This overall pattern of group differences in the MMH sample is partially consistent with previous research in non-retarded samples. Goyette, Conner, and Ulrich (1978), using a slightly modified version of the ACRS, found their two male groups and the older females to be similarly rated but their younger females were rated as better behaved. In this study, the two male groups and the younger females were similarly rated but the older females received better ratings. It would appear that the MMH sample is more consistent with general expectations because males are usually rated as more hyperative than females and younger children usually more hyperactive than older ones (Kerasotes & Walker, 1983).

ADHD Prevalence Rates

Using the cutoff of 1.5 or greater on the ACRS as a measure of ADHD revealed that this MMH sample was rated as demonstrating a fairly high degree of ADHD behavior. Thirty-three percent of the overall group received scores of 1.5 or more. The percentage of subjects by age and sex scoring in this range is presented in Table 3. According to the test for significance between two proportions, a statistically significant proportion of the older males scored above the cutoff than the older females. No other significant proportion differences were recorded.

Previous research with nonclinical samples has suggested that the standard 1.5 ADHD cutoff is too liberal, producing too many false positives (Trites, 1978; Ullmann et al, 1985). Nevertheless, applying

the most stringent cutoff criteria (e.g., 2.3 proposed by Ullmann and his associates, 1985) still yields excessively high ADHD ratings in this mentally retarded adolescent sample.

Item Analysis

Item analysis of the ACRS and the ACL (see Appendix C, Table C-1 and Table C-2, respectively) showed good discrimination among the items on each of the two rating scales. Good reliability was established for the ACRS ($r = .94$, $SE_m = 1.92$) and for the ACL ($r = .96$, $SE_m = 1.81$).

Factor Analysis of ACRS

Principal component factor analysis with varimax rotation was used to identify the underlying attributes of the ACRS. Two factors with eigenvalues greater than one (Kim & Mueller, 1978) were extracted. These factors are shown in Table 4. An alternate factor analysis with oblique rotation was also conducted and did not yield different results.

The first factor incorporates the first seven items of the ACRS and seems to represent the composite behaviors that make up ADHD as defined by the DSM-III-R (APA, 1987), including the elements of hyperactivity, inattentiveness, and impulsivity.

The second factor, which is much weaker, is made up of items 8 through 10 and seems to represent the temperament aspects of behavior.

These factors are somewhat different from those obtained by Brown (1986) in his study of the ACRS with non-retarded children. Brown generated two factors, Emotional Lability/Conduct (Items 1, 2, 3, 5,

Table 4

Factor Analysis - ACRS Principal Component with Varimax Rotation

(N = 100)

ACRS Item	Factor 1 (ADHD composite)	Factor 2 (Temperament)
Restless or overactive	.88*	.27
Excitable, impulsive	.77*	.44
Disturbs other children	.87*	.26
Fails to finish things he starts, short attention span	.66*	.27
Constantly fidgeting	.94*	.11
Inattentive, easily distracted	.89*	.22
Demands must be met immediately easily frustrated	.65*	.58
Cries often and easily	-.01	.87*
Mood changes quickly and drastically	.50	.77*
Temper outbursts, explosive and unpredictable behavior	.52	.74*
Eigenvalues	6.62	1.22
Percent Variance	66.20	12.20

*Loading above .60 have been marked.

and 7) and Attention/Concentration (Items 4 and 6), which are subsumed into the first composite behavior factor obtained here. Brown's Emotional Lability/Conduct factor explained 32.4% of the variance and his Attention/Concentration factor explained 15.5% of the variance. The composite behavior factor obtained in this study explained 66.2% of the variance. Brown's second factor, Temperament, is identical in nature to the second factor obtained here. However, Brown's Temperament factor accounted for 23.6% of the variance whereas the Temperament factor generated here accounted for less variance, 12.2%.

It must be noted that Brown's sample came from a clinical population. All subjects were diagnosed as Attention Deficit Disorder (ADD) according to the DSM-III (APA, 1980). A considerable portion of his sample (over one-third) were specifically diagnosed as ADD without hyperactivity. This might account for the emergence of the distinct Attention/Concentration factor in his study but not in the current one. Brown's study will be referred to again in the discussion of the combined ACRS and ACL factor analysis.

Factor Analysis of ACL

Principal component factor analysis with varimax rotation was used to identify attributes of the ACL. One factor, accounting for 70.7% of the variance, was obtained and is presented in Table 5. All items entered significantly into the single factor of attention as measured by the ACL.

Factor Analysis of ACRS and ACL

Items from both checklists were analyzed by principal component

Table 5

Factor Analysis - ACL Principal Component with Varimax Rotation

(N = 100)

ACL Item		Factor 1
1.	Does the child have a short attention span?	.90
2.	Does the child appear detached from class activities?	.74
3.	Does the child accurately heed directions?	.72
4.	Does the child daydream in class?	.72
5.	Does the child have trouble concentrating?	.89
6.	Does the child stay with one activity long enough to complete it?	.87
7.	Does the child work independently?	.87
8.	Is the child easily distracted?	.86
9.	Is the child able to concentrate on a task until completed?	.88
10.	Does the child listen attentively?	.90
11.	Does the child become easily engrossed in an activity?	.85
12.	Does the child disregard some or all directions?	.84
	Eigenvalue	8.48
	Percent Variance	70.70

factor analysis with varimax rotation. Three factors were obtained and are shown in Table 6.

The first factor accounting for 63.5% of the variance consisted of all items of the ACL and the two items of the ACRS (fails to finish things he starts, short attention-span; and inattentive, easily distracted) that comprised Brown's (1986) attention factor. This factor is attentional in nature. The exceptionally high proportion of variance accounted for by this factor is likely a function of the strong intercorrelations among the items of the ACL. It should be noted that Item 6 of the ACRS and Item 8 of the ACL also loaded on the second factor.

The second and third factors account for 8% and 6% of the variance, respectively. The second factor is made up of Items 1, 2, 3, 5, 6, and 7 of the ACRS and Item 8 of the ACL. This factor is fairly consistent with Brown's first factor, Emotional Lability/Conduct, and somewhat similar to the first factor obtained with this factor analysis of the ACRS. The third factor, consisting of Items 8, 9 and 10 of the ACRS, is the same as Brown's second factor and the second factor obtained with this factor analysis of the ACRS, namely temperament.

A principal component factor analysis with oblique rotation was also conducted on the combined scales (see Appendix D, Table D-1 and Table D-2). The factors yielded were less clear but the three factors were maintained. Of interest was the strong correlation demonstrated between the first factor, attention, and the second factor, hyperactivity/impulsivity ($r = .64$).

Table 6

Factor Analysis - Combined ACRS and ACL Principal Component with Varimax Rotation (N = 100)

Item #1		Factor 1 (Attention)	Factor 2 (Hyperactivity-Impulsivity)	Factor 3 (Temperament)
ACRS	1	-.23	.90*	.21
	2	-.26	.75*	.39
	3	-.32	.83*	.19
	4	-.85*	.28	.15
	5	-.42	.84*	.03
	6	-.56*	.72*	.12
	7	-.39	.60*	.50
	8	-.14	.02	.86*
	9	-.32	.47	.71*
	10	-.31	.51	.68*
ACL	1	.72*	-.52	-.21
	2	.69*	-.22	-.19
	3	.64*	-.35	-.01
	4	.68*	-.16	-.25
	5	.75*	-.50	-.06
	6	.85*	-.18	-.28
	7	.75*	-.34	-.29
	8	.58*	-.64*	-.28
	9	.82*	-.25	-.28
	10	.75*	-.47	-.19
	11	.78*	-.33	-.15
	12	.64*	-.52	-.11
Eigenvalues		13.97	1.75	1.32
Percent Variance		63.50	8.00	6.00

*Loadings above .55 have been marked.

Correlations

Pearson correlation coefficients indicated a significant correlation between the total scores of the ACRS and the ACL ($r = .84$).

Summary: Identifying ADHD in the Mildly Mentally Retarded

The findings of this study suggest that: (1) in regard to prevalence, this familial mildly mentally retarded sample displayed more ADHD behaviors than the non-retarded population; and (2) consistent with previous research on a non-retarded population, the components of attention, hyperactivity/impulsivity, and temperament can be identified in MMH adolescents. Thus, the ACRS and the ACL have been further validated and extended to a population of MMH adolescents.

Despite the apparent differences in the attributes that the two scales assess (attention by the ACL and the ADHD composite and temperament by the ACRS) the two scales are highly correlated; $r = .84$. This suggests a close relationship between these dimensions. Thus, the ADHD problems may represent more of a syndrome rather than individual problem areas.

From this syndrome perspective, attention is recognized as a problem area for ADHD children. The ACRS and ACL as potential assessment tools for ADHD should thus differentiate between children with and without attention problems. The validity of the ACRS and the ACL in attention assessment was further examined in Study Two.

CHAPTER 4

Study Two

External Validation of the ACRS and ACL

Introduction

The concurrent validity of the Abbreviated Conners Rating Scale (ACRS) as a measure of attention was supported in Study One using a familial mildly mentally handicapped (MMH) adolescent sample. The validity was confirmed by the strong correlation ($r = .84$) between the ACRS and Attention Checklist (ACL). The factor analysis of the combined scales demonstrated a strong correlation between the attention factor and the hyperactivity/impulsivity factor, thus, offering further supportive evidence of the validity of the ACRS in attention assessment.

Further empirical validation for the ACRS and ACL was sought in Study Two. Because the ACRS and the ACL are supposed to identify attention problems in children, those children who are rated poorly on both scales (e.g., high scores on the ACRS and low scores on the ACL) should demonstrate poor attention. Furthermore, these "Poor Attenders" should perform differently on attention-demanding tasks than those identified as "Good Attenders" by the ACRS and ACL ratings. To test this hypothesis, two groups of MMH adolescents, one designated as Good Attenders and the other as Poor Attenders based on the teacher ratings from Study One, were compared on sustained and selective attention tasks.

Method

Subjects

A sample of 26 familial MMH adolescents was drawn from Study One, a study in which 100 MMH adolescents were evaluated with the ACRS and the ACL. Thirteen subjects (eight male, five female) identified as Good Attenders, and 13 subjects (six male, seven female) identified as Poor Attenders were selected. The group designated as "Good Attenders" was required to score at least one standard deviation below the mean on the ACRS and at least one standard deviation above the mean on the ACL. Those subjects designated as "Poor Attenders" were required to score at least one standard deviation above the mean on the ACRS and at least one standard deviation below the mean on the ACL. All Poor Attenders scored at least 1.5 or greater on the ACRS, the recommended minimum cutoff score in ADHD assessment. Subject characteristics including chronological age, full scale IQ, and ACRS and ACL scores for both groups are provided in Table 7. There were no mean differences between groups in chronological age or IQ.

Instruments

Sustained Attention Task. The sustained attention task was a modified version of the Continuous Performance Test (CPT) (Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956), a test originally designed to monitor lapses in attention in brain injured persons. The current CPT version required the auditory detection of the name "Liz" only when preceded by the name "Pete". Critical signals (Pete-Liz) occurred three times per minute and were embedded in a series of names. Four

Table 7

Subject Characteristics for Study Two

	Good Attenders			Poor Attenders		
	Range	Mean	SD	Range	Mean	SD
CA (in years)	12.5-16.2	14.6	1.3	12.0-16.0	13.8	1.4
IQ*	58.0-89.0	71.2	8.9	59.0-81.0	71.5	7.2
ACRS	0.0- 0.2	0.07	0.09	1.9- 2.9	2.3	.33
ACL	43.0-48.0	46.1	1.8	13.0-24.0	19.2	3.6

*Wechsler Intelligence Scale for Children - Revised scores from school files.

girls' names (Ann, Sue, Jane and Liz) and four boys' names (Dave, Doug, Paul and Pete) were presented randomly at a rate of one per second over a ten minute period. Subjects were required to tap a table loudly after hearing the critical signal. Errors of omission were scored in two minute intervals and as a total score. Errors of commission (false alarms) were recorded as a total score. The full task description and record sheet are presented in Appendix E.

Selective Attention Tasks. The selective attention tasks were an adapted format of the standard Posner matching tasks. The original tasks were developed to assess the ability to select one kind of information over another (Posner & Boies, 1971). There were two selective attention tasks used in this study, a Physical Match (PM) task and a Name Match (NM) task.

In the PM form, the subject's task was to find and circle picture pairs in which both members were identical. Twelve rows of pictures, each containing seven pairs, were presented on one page. Of the 84 total pairs, 20 comprised identical pictures whereas the remaining distractor pairs were unmatched items. Subjects were instructed to work as quickly as possible. Number of correct responses, time, and rate (number of seconds per correct response) were scored. Appendix F contains the guided directions, practice sheets and test.

The NM form followed the same format and scoring procedure as the PM form. Under the NM condition, the subject's task was to find and circle pairs of items in which both members were from the same category (e.g., two flowers, two animals). The distractor pairs were pictures

of items from two different categories (e.g., an animal and a flower, a fruit and a face). The NM form and practice sheet are presented in Appendix G.

Procedure

All testing was conducted at the school attended by the subjects. Testing was individualized and took place in a small, quiet office. A sign was posted to prevent disruptions during the vigilance and selective attention tasks.

The sustained and selective attention tasks were administered in a counterbalanced order between groups and within each group for sex, as much as was possible. The PM form of the selective attention tasks, however, was administered before the NM form in all cases. This procedure was followed to provide consistency with other research for comparison purposes.

The subjects received instruction and guided practice on all tasks and 100% mastery on the practice trial was required before proceeding with the tests. The total testing time varied with each subject according to the time needed to learn the tasks. Generally, this was 20 to 30 minutes.

Results

Task Means and Standard Deviations

The means and standard deviations for the sustained attention task and the selective attention tasks are summarized in Table 8. Overall, the performance of the Poor Attenders was somewhat poorer and more variable than that of the Good Attenders with the exception of the

Table 8

Means and SDs for Task Performance

	Group			
	Good Attenders		Poor Attenders	
Task	Mean	SD	Mean	SD
Sustained Attention				
1st - 2 minutes*	1.08	0.64	1.15	0.90
2nd - 2 minutes*	1.69	1.70	2.23	2.20
3rd - 2 minutes*	2.54	1.33	2.62	2.25
4th - 2 minutes*	2.15	1.63	2.92	2.53
5th - 2 minutes*	1.92	1.61	3.00	2.38
Total Omissions	9.39	4.74	11.92	9.58
False Alarms	3.77	4.09	2.15	2.73
Selective Attention - PM				
Total Correct (max.=20)	18.54	1.71	18.00	1.92
Total Time (in seconds)	42.92	9.94	59.15	32.47
Rate	2.34	0.59	3.36	1.99
Selective Attention - NM				
Total Correct (max.=20)	15.54	2.99	14.31	3.30
Total Time (in seconds)	69.00	16.30	88.77	20.83
Rate	4.64	1.63	6.68	2.84

*Errors of omission per two-minute period. Maximum number of errors is 6.

number of false alarms recorded on the vigilance task.

Sustained Attention Task

A two group analysis of variance (ANOVA) with repeated measures was used to analyze the errors of omission over the five two-minute intervals of the sustained attention task. The results are summarized in Table 9. No overall group differences and no interaction between groups and time was recorded. However, there was a statistically significant main effect across time. Figure 1 shows a significant increase in the number of errors of omission for the total sample over the first six minutes and a stablizing trend in the last four minutes. This observed decrement pattern is consistent with that obtained by Sykes, Douglas, and Morgenstern (1973) with ADHD children. Using a similar auditory sustained attention format, their ADHD group showed a decline in performance after the first five minutes and a subsequent leveling-off effect whereas their normal control group did not show a marked decline in performance.

Although significant group differences were not obtained, Figure 1 also shows a trend toward performance differences in the last two minutes of the task. Independent groups t-tests approach significance for the last time block ($t = -1.35$, $df = 24$, $p < .189$). The performance of the Poor Attenders continued to deteriorate as the task progressed whereas greater consistency was observed in the performance of the Good Attenders.

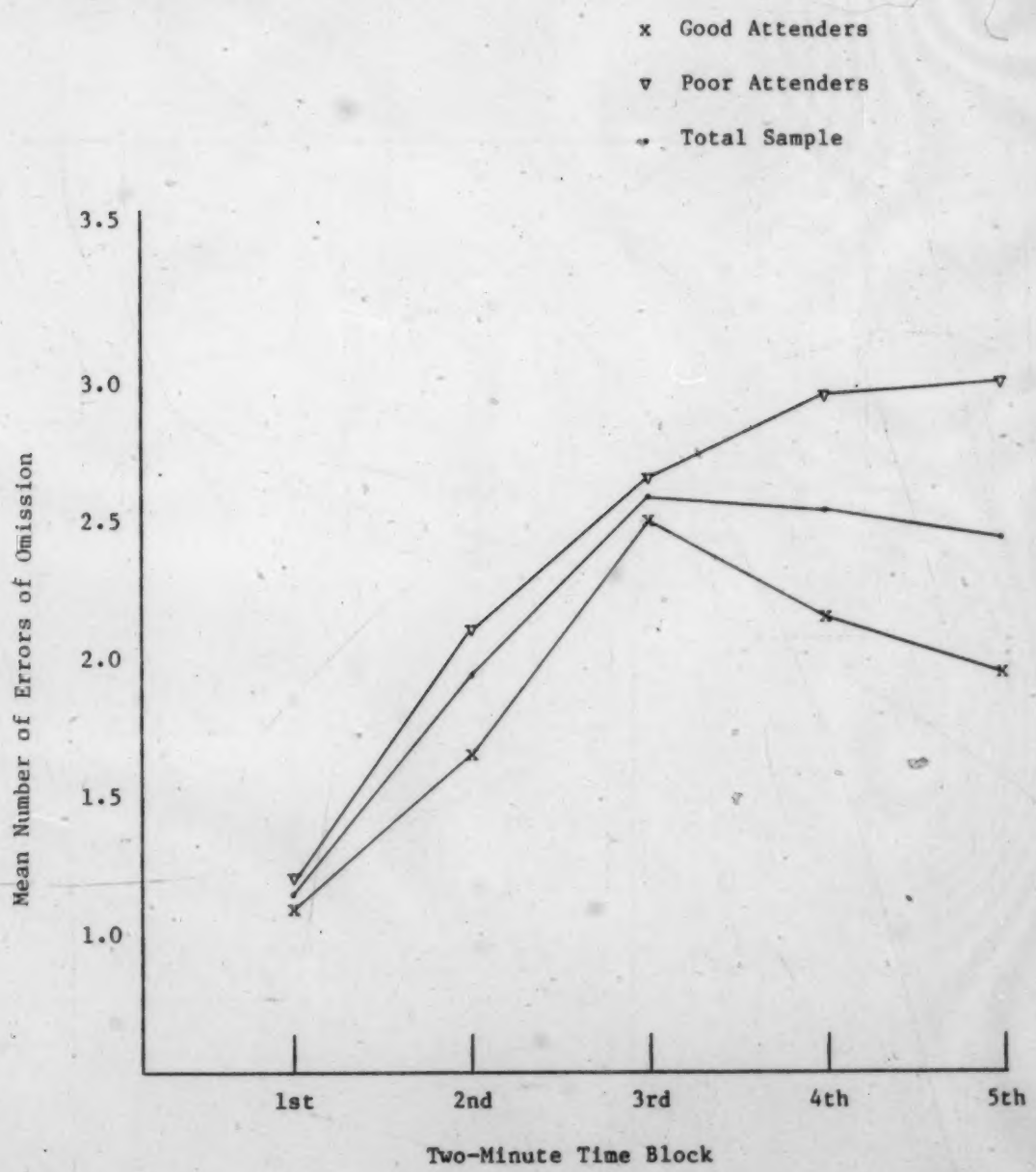
Two independent groups t-tests were used to compare the Good and Poor Attenders in overall task scoring. No statistical difference was

Table 9

Summary of Analysis of Variance for the Five Two-Minute Intervals of the Sustained Attention Task

Source	ss	df	MS	F	p
Good vs Poor Attenders	8.377	1	8.377	0.734	.400
Subjects Within	273.999	24	11.417		
5 Time Intervals	39.892	4	9.973	7.750	.001
Attenders x Intervals	4.969	4	1.242	0.965	.430
Task-Subjects Within	123.540	96	1.287		

Figure 1. Mean number of errors of omission over five two-minute time intervals for Good Attenders (n = 13), Poor Attenders (n = 13), and Total Sample (n = 26)



revealed in the total number of errors of omission ($t = .86$, $df = 24$, $p < .40$) or in the total number of false alarms ($t = 1.18$, $df = 24$, $p < .25$)

In summary, these results demonstrate that the two groups of MMH adolescents cannot be adequately distinguished on the sustained attention measure used in this research although a trend toward performance differences between groups was observed. This finding is contrary to expectations because in past research with ADHD children, sustained attention tasks have been one of the more reliable measures in differentiating between ADHD and non-ADHD children (Douglas, 1983). However, the sample as a whole did perform more like ADHD children than normal children on this task.

Selective Attention Tasks

A 2 x 2 repeated measures analysis of variance was used to analyze the data obtained from the selective attention tasks. The results are summarized in Table 10.

A statistically significant main effect was demonstrated between the Physical and Name Match tasks. The Name Match task produced significantly fewer correct responses, required significantly more time to complete, and, it follows, required more time to generate one correct response (rate). The finding that Name Match took longer to complete and generated fewer correct responses than Physical Match is consistent with previous research on other Posner-type Physical and Name Match tasks (Bisanz, Danner, & Resnick, 1979; Posner & Boies, 1971) and with results obtained using the current version of the tasks

Table 10

Summary of Analysis of Variance for Physical Match and Name Match Tasks

Measure	Source	SS	df	MS	F	p
No. Correct	Group*	10.172	1	10.172	1.044	.317
	Subjects Within	233.852	24	9.744		
	Task*	145.558	1	145.558	41.896	.001
	Group x Task	1.558	1	1.558	.449	.509
	Task-Subject Within	83.383	24	3.474		
Time	Group	4212.000	1	4212.000	5.753	.025
	Subjects Within	17572.000	24	732.167		
	Task	10080.332	1	10080.332	51.905	.001
	Group x Task	40.676	1	40.676	.206	.651
	Task-Subject Within	4660.938	24	194.206		
Rate	Group	30.424	1	30.424	4.838	.038
	Subjects Within	150.927	24	6.289		
	Task	102.800	1	102.800	85.034	.001
	Group x Task	3.371	1	3.371	2.788	.108
	Task-Subject Within	29.014	24	1.209		

*Note. The "Group" comparison is between the Good and Poor Attenders as defined by ACRS and ACL ratings. The "Task" comparison is between the PM and NM selective attention tasks.

with a non-clinical population (Das, 1986a).

Overall group differences are of great interest for this study. The analysis has shown that, in the time taken to complete the tasks and the time taken to generate one correct response, the Good Attenders outperformed the Poor Attenders in both cases. No difference between groups was observed in the number of correct responses, which appears to be the least sensitive of the dependent variables.

No interaction between Group and Task for correct response, time, or rate was shown. This implies that even in the simple form, physical matching, the Poor Attenders were slower. Category match, in the second task form, did not discriminate the groups any better.

Thus, the mildly mentally handicapped adolescents in this study performed similarly to other populations on the Physical and Name Match tasks. The selective attention tasks did discriminate between the Good Attenders and Poor Attenders with the time factor being the critical element in their performance.

Summary: External Validation of the ACRS and ACL in Attention Measurement

The results of the second study provide strong support for the validity of the ACRS and the ACL as predictors of selective attention. The mildly mentally handicapped adolescents identified as Good Attenders by the rating scales significantly outperformed those identified as Poor Attenders on the selective attention task.

The sustained attention task failed to discriminate between groups. This finding was somewhat surprising. It was expected that

performance on the sustained attention task would be the more discriminating test because previous research has fairly consistently supported a sustained attention deficit in ADHD children (Douglas & Peters, 1979; Douglas, 1983). With the ACRS used in ADHD assessment, the Poor Attenders were expected to perform like ADHD children and the Good Attenders, like non-ADHD children. However, in this MMH adolescent sample, no group differences were found in vigilance performance. Rather, the overall performance of the total group in terms of decrement in vigilance tended to resemble that of ADHD children tested on auditory CPT tasks in a previous study (Sykes, Douglas, & Morgenstern, 1973).

Thus the ACRS and ACL do appear to be assessing attention as evidenced by the differentiation on the Physical and Name Match tasks. The specific aspects of attention that seem to be tapped in this MMH adolescent group by the rating scales are suggested to be selective in nature.

CHAPTER 5

Discussion

The current research was undertaken to serve two purposes. The first purpose was to examine the Abbreviated Conners Rating Scale (ACRS) (Conners, 1973) and the Attention Checklist (ACL) (Das, 1986b) as instruments which would be appropriate for use with familial mildly mentally handicapped (MMH) adolescents. Specifically, the prevalence of ADHD in this sample based on ACRS ratings and the factor structure of the scale derived from these ratings were explored. A second purpose was to evaluate the adequacy of the ACRS in its treatment of the attention component of ADHD. This was achieved (1) by comparing the teacher ratings on the ACRS to those on the ACL; and (2) by comparing children's ACRS and ACL ratings to their performance on objective attention measurements.

In Study One, the two rating scales, the ACRS and the ACL, were administered to the teachers of 100 familial mildly mentally handicapped adolescents. Thirty-three percent of the sample were found to score 1.5 or greater on the ACRS, a score traditionally used as the standard for identifying ADHD with the ACRS. The factorial analysis using varimax rotation and principal component factoring indicated that two factors, one representing the ADHD symptom complex (hyperactivity/inattention/impulsivity) and the other, temperament, accounted for 78.4% of the variance of the ACRS. This factor structure was similar to that generated from data on a non-retarded group. On the ACL, one

factor, representing attention and accounting for 70.7% of the variance, was identified. The factor analysis of the ACL and ACRS combined saw the emergence of three factors (attention, hyperactivity/impulsivity, and temperament) accounting for 77.5% of the variance. The correlation between the ACRS and ACL was quite high (r = .84).

In Study Two, MMH adolescents designated as Good Attenders (n = 13) and Poor Attenders (n = 13) based on the ACRS and ACL ratings in Study One were administered sustained and selective attention tasks. The sustained attention measure was a Continuous Performance Task (CPT) whereas the selective attention measures were Posner-type Physical Match and Name Match Tasks. The results showed that the sustained attention task failed to discriminate the Good Attenders from the Poor Attenders but that the selective attention tasks did differentiate between groups.

In general, this study points to evidence that the ACRS and the ACL can be appropriately used with the mildly mentally handicapped in the assessment of ADHD. Furthermore, the findings suggest that the ACRS and ACL are effective in assessing attention deficits in the mentally handicapped, particularly deficits in selective attention.

Outline of the Discussion

The results of this study will be discussed in four sections. In the first section the results obtained from the Abbreviated Conners Rating Scale (ACRS) in relation to prevalence rates in the mildly mentally retarded will be covered. The second section will discuss the ACRS and the ACL in terms of factorial structure and the relationship

between the two scales. The third section discusses the relationship of the ACRS and ACL ratings to external measures of sustained and selective attention. The last section presents suggestions for further research.

ADHD Prevalence in Mildly Mentally Handicapped Adolescents

The ADHD prevalence rate of 33% observed in this study of familial MMH adolescents was substantially greater than what would be projected for a normal population. Previous estimates of ADHD prevalence have ranged from 2 to 20% (Barkeley, 1981) but a 3-5% rate is generally accepted as the most realistic figure (Barkeley, 1987). Because familial MMH individuals are theoretically considered to represent the lower extreme of the normal population curve, it was predicted that the ADHD prevalence rate in this sample would not differ greatly from that in the normal population.

There are a number of possible explanations for the high prevalence rate obtained here. First, this estimate of ADHD prevalence was based on a statistical approach to ADHD definition. The ACRS cutoff score of 1.5 or greater that was derived from the original norming data on the rating scale (Werry, Sprague, & Cohen, 1975) was used as the standard to define ADHD in this study. Recently, it has been suggested that this 1.5 cutoff is too liberal in identifying children as ADHD. Ullmann, Sleator, and Sprague (1985) have argued that the original norming data was generated from a nonrandom sample of "supranormal" children. Thus, the lower group mean and narrower standard deviation in this group produced an excessively low cutoff

point. Ullmann and his associates (1985) have since re-normed the ACRS on a larger sample comprising grade two and three children and generated 2.3 as the cutoff score based on ratings two standard deviations above the overall group mean. However, although a larger sample was rated, the sample is more restrictive in age range than in the original norming study. It has not been proven whether the new 2.3 cutoff point is more valid an index. Nonetheless, even in the application of this more stringent criterion, 11% of the familial MMH sample were identifed as ADHD. This would suggest that there is a significant subgroup of the MMH population that is affected by ADHD.

The second possible explanation for the high prevalence rate observed is sample bias. If segregated schools, such as the one from which this MMH sample was drawn, receive placement of a disproportionate number of ADHD students, then the prevalence rate would be higher than projected. Because ADHD students tend to be disruptive and difficult to teach in a regular classroom (Whalen & Henker, 1985), the possibility exists that lower ability students with ADHD behavior may be more likely than lower ability students without adaptive behavior problems to be placed in a segregated rather than integrated environment. The subjects in this study, then, may not be representative of the familial MMH population in general.

A third alternative explanation is that the mildly mentally retarded may be a high risk population and that the original prevalence predictions were not tenable. In the DSM III (APA, 1980) it was stated

that the mildly retarded are predisposed to ADHD. Evidence for this position is available from an extensive survey of maladaptive behaviors in mentally retarded persons in which hyperactivity was rated as a serious behavior problem in 16-18% of the sample (n = 2688) of mildly and moderately retarded adolescents and adults (Eyman & Call, 1977). The results of this study might be interpreted to suggest that the mentally retarded are a high risk population for ADHD.

Although it is difficult to draw definitive conclusions on the ADHD prevalence rate in the familial mildly mentally retarded without further research support, the results of this study point to evidence that a significant number of familial MMH adolescents are affected by ADHD, particularly those adolescents in segregated settings.

Implications

The presence of a significant subgroup of ADHD individuals in the MMH population has implications for educational and research practices pertaining to the mentally retarded. In terms of education, remedial programs that have shown potential with non-retarded ADHD children may be valuable additions to the individualized educational plans of ADHD-MMH children. In research, the recognition of a substantial ADHD subgroup could identify another important dimension in the heterogeneous MMH population. Should further research substantiate the high ADHD prevalence rate obtained in this study, there may be a need to account for an ADHD-MMH subgroup in sample selection in future studies with the mentally retarded, particularly in research focusing on attention and other cognitive processes.

The ACRS and ACL

Factor Structure of the ACRS

The findings of this research indicate that teacher ratings of MMH subjects on the ACRS assess two dimensions of school behavior (hyperactivity/inattention/impulsivity and temperament). The first factor represents a cluster of behaviors that are compatible with the characteristics considered as the primary diagnostic features of ADHD, those being hyperactive, inattentive, and impulsive behavior. This provides evidence that ADHD as exhibited in the MMH population is a constellation of related behaviors that present not unlike in the non-retarded population.

The second factor, temperament, which includes such items as "mood changes quickly and drastically" is of interest. These items seem to be evaluating control over emotional behavior. In the current study this factor accounted for only a small portion of the variance (12.2%) whereas in the factor analytic study of Brown's (1986) with non-retarded children the temperament factor made a somewhat larger contribution (23.6%). Perhaps this difference is the result of a wider range of behavioral tolerance by the teachers of the mentally retarded. Because the MMH are defined by deficits in adaptive behavior, the temperamental aspects of behavior may need to be very extreme before they are considered problematic to the teachers in the segregated school. The results of this study, taken together with Brown's (1986) findings, however, suggest that there is an association between maladaptive temperament and the ADHD syndrome.

Relationship of the ACRS and the ACL

The results showed that the teacher ratings of MMH adolescents as measured by the ACRS and the ACL combined evaluated three dimensions of behavior (attention, hyperactivity/impulsivity, and temperament). This finding indicates that teachers of the MMH were sensitive to different attributes and underscores their value as sensitive raters in the assessment of ADHD.

With regard to the emergent factor structure in the combined analysis, the temperament factor that was demonstrated in the ACRS remained unchanged. However, the addition of the 12 attention items of the ACL produced the separation of the ADHD composite factor of the ACRS into an attentional component and a hyperactive/impulsivity component. Of interest was the strong correlation ($r = .64$) demonstrated between the attention factor and the hyperactivity/impulsivity factor.

This evidence in combination with the strong correlation ($r = .84$) shown between the total score of the ACRS and that of the ACL suggests that poor attention is an inseparable part of the ADHD symptom constellation and speaks strongly in favor of a syndromal perspective to ADHD. Furthermore, it can be interpreted that the behavioral deficits measured by the ACRS and the cognitive deficits in attention assessed by the ACL are interrelated.

Further support for the interrelationship between the ACRS and ACL was demonstrated in the subject selection for Study Two. At the time this study was conducted the DSM III (APA, 1980) definition of

Attention Deficit Disorder (ADD) was still in place and two subtypes of the disorder, ADD without hyperactivity and ADD with hyperactivity, were recognized. It was anticipated that a subgroup of subjects would present as ADD without hyperactivity having poor ratings on the ACL, indicating attention problems, but good ratings on the ACRS, indicating an absence of hyperactivity. However, this was not seen. The overlap between the scales was extensive. Only a total of nine subjects scored one standard deviation (SD) above the mean of the ACRS (poor rating) or one standard deviation below the mean of the ACL (poor rating) without receiving an equivalent rating on the other scale. Of the nine, all but two were within one item score (0.3 points on the ACRS and 4 points on the ACL) of being within the one standard deviation cutoff of both scales.

In light of the demonstrated relationship between the ACRS which specifically rates subjects on overactivity, impulsivity and mood changes and the ACL which rates subjects on attention, it is not surprising that the subtype "Attention Deficit Disorder without hyperactivity" was eliminated as a diagnostic subtype of the disorder in the recent DSM III-R (APA, 1987). Consistent with this research, field studies had indicated that the diagnosis of ADD without hyperactivity was "hardly ever made" (DSM III, 1987, p. 411).

Caution must be taken in interpreting the relationship demonstrated between the ACRS and the ACL. It is possible that rater bias may have contributed to the strong correlation obtained. In this study, the teachers completing the rating scales were familiar with the

students being evaluated. As a result, the teachers' previous global impressions of the individual students may have systematically biased the responses on both scales. Therefore, an artificially high correlation between scales would be recorded. Any research which involves the use of questionnaires is vulnerable to this source of error. However, the external validation of the ACRS and the ACL based on objective measures of attention suggests that rater bias had a limited effect on the ratings in this research.

Implications

The ACRS and the ACL have potential to yield valuable information about the behavioral, attentional and temperamental deficits of the ADHD child. The ACRS offers the advantages of good reliability, validity, and standardization and this research supports the use of the ACRS with the mildly mentally handicapped in the assessment of ADHD. The ACL provides an additional dimension to the assessment information by identifying more specific aspects of attention problems. Considering both scales are simple to use and are time and cost efficient, the information gained from the combined use of these instruments could contribute much to the assessment of ADHD in the mildly mentally handicapped with minimal financial and personnel costs.

External Attention Measures

Sustained Attention Task

The vigilance task used in this research did not differentiate the MMH adolescents who were identified as Good Attenders based on the ACRS

and the ACL from those who were identified as Poor Attenders based on both measures. This finding was in contrast to the results of the majority of sustained attention studies of non-retarded ADHD children in which similar CPT tasks have been employed.

In examining the effectiveness of the task as a possible source for the negative findings, the results suggest that the CPT task format used may have been inadequately designed. The trend toward group differences observed in the latter minutes of the test suggests that, had the task been longer in duration, statistically significant group differences may have been recorded. Although the task did demonstrate positive attributes like good discriminatory value between subjects as indicated by the wide range of scores and a decrement pattern consistent with previous research (Sykes, Douglas, Weiss, & Minde, 1973), the failure to prolong the task time may have restricted the effectiveness of the task in detecting group differences.

Modality of presentation may also have influenced the findings. The majority of CPT studies with ADHD children in which differences were reported administered a visual task (O'Dougherty, Nuechterlein, & Drew, 1984; Sostek, Buchsbaum, & Rapoport, 1980; Sykes et al, 1971; Tarnowski, Prinz, & Nay, 1986). It has been hypothesized that the visual modality requires more effortful control over attention than the auditory format (Draeger, Prior, & Sanson, 1986). Only one study (Sykes et al, 1971) using the auditory format reported a difference between ADHD and control groups. Thus, a visual format may be more sensitive to slight lapses in attention than the auditory one

administered in this study.

The results of this study are, however, consistent with those of Draeger, Prior, and Sanson (1986) in their study of the effects of self control on attentional performance of ADHD children. Draeger and her associates (1986) tested ADHD and control children on visual and auditory sustained attention tasks under two conditions, one in which the experimenter (E) was present and one in which the E was absent. They found no significant differences between groups on either task when the E was in the room. However, when the E was absent, the performance of the ADHD group deteriorated significantly. They suggested that the E had a motivating and controlling impact on the ADHD children and interpreted the results as supporting evidence for a deficit in internal control. In a number of CPT studies in which deficits in sustained attention have been found, the E was not present (Sykes et al, 1971; Sykes et al, 1973) and in the remainder it is not clear whether or not the E was in the room. In light of Draeger, Prior, and Sanson's (1986) findings, the results of these studies can be questioned. In the current study, the E was present throughout testing and, thus, may have influenced the performance of the subjects.

In the previous research with adolescent and adult mentally handicapped subjects, deficits in sustained attention have not been reported (Warm & Birch, 1985). In this study, the decline in performance over time observed in both Good Attenders and Poor Attenders was similar to that of ADHD subjects in one study (Sykes et

al, 1973) and to that of learning disabled (LD) subjects in another (Swanson, 1980). Auditory CPT tasks were used in both studies and the average ability non-ADHD control groups in both studies did not show a significant decline in performance over the testing time. Of interest is that the LD subjects in Swanson's study were screened on the Conners Rating Scale to eliminate ADHD as a confounding variable. Because the literature has not supported a vigilance deficit in LD children (Tarnowski, Prinz, & Nay, 1986), the question is raised as to what other factors may be affecting performance on the auditory CPT outside of attentional processes. The possible effects of an external motivating factor, like experimenter presence, was discussed earlier. On this long, tedious monitoring task, internal motivation may also play a part. Because there are no obvious purposes to the task nor apparent benefits to the subjects, the subjects' internal level of motivation may drop after the initial novelty of the task has worn off. Thus, a decline in performance would be observed. Another possible factor might be memory. Over the ten minute course of the task, the non-target signals present a continuous stream of competing stimuli that may weaken the stimulus trace of the target signal. As the task progresses, then, a decrement in performance would be demonstrated.

A further consideration in regard to the CPT is whether the dimension of attention assessed is relevant to classroom performance. In practical terms, how closely does this task relate to classroom tasks? In the author's opinion, there does not appear to be a direct counterpart in the school setting. Curriculum is theoretically

designed to avoid monotony and boredom, elements that are essential and differentiating features of the CPT. It is reasonable, then, that the aspects of attention being evaluated by teacher ratings do not coincide with the attention demands of the CPT and that subjects identified by teachers as Poor Attenders and Good Attenders would not be differentiated by this task.

Thus, the failure of the sustained attention task to detect deficits may have come from a number of sources. These include inadequate task length, a task format that was not sensitive enough to slight lapses in attention, an external controlling influence, other person-variables like motivation and memory, and poor correspondence between teachers' perceptions of attention deficits and the attentional demands of the task.

Selective Attention Tasks

The selective attention tasks did differentiate between the two subsamples of MMH adolescents. The Poor Attenders showed a deficit in their selective attention skills as measured by the Physical Match (PM) and Name Match (NM) tasks. However, the deficits did not exhibit in the way that was expected. Because the PM task has few cognitive demands and the NM task is more demanding, it was expected that the deficits would be much more apparent on the NM form. This prediction was based on the conclusion from the literature review that selective attention deficits in ADHD tend to appear on tasks with greater cognitive demands. The Poor Attenders demonstrated deficits on both tasks relative to the Good Attenders.

Three dependent variables were assessed in the selective attention tasks: number of correct responses, time, and rate (number of seconds per correct response). Both groups performed similarly in the number of correct responses generated suggesting that both groups were equally sensitive or insensitive to the target stimuli. However, the significantly greater amount of time used by the Poor Attenders, as indicated by the significant differences between groups on time and rate on both tasks, is suggestive of deficits in attention control.

The PM-NM tasks were very short in duration: times ranged from 36 to 120 seconds. Students were aware from the practice trials and the instructions that they needed to work as quickly as possible and that they were beimg timed. The tasks demanded consciously controlled attention throughout. Despite this need to stay focused, the Poor Attenders were observed to look up from the tasks and to readjust their posture more often than the Good Attenders. Such behavior suggested to the experimenter that the Poor Attenders had insufficient control over their attention.

In conclusion, the results from the selective attention tasks strongly support the validity of the ACRS and the ACL in attention assessment. In contrast to findings of Ullmann, Sleator, & Sprague (1985), this research indicates that the ACRS is adequate in the assessment of the attention component of ADHD and that it should continue to be used as an assessment instrument of ADHD.

Implications

The Physical Match-Name Match selective attention tasks employed

in this study may prove to be valuable instruments in the assessment of attention deficits. The tasks clearly differentiated individuals identified by teachers as Good Attenders from those identified as Poor Attenders. This suggests that the dimensions of attention required to successfully complete the PM-NM tasks are compatible with those elements of attention that teachers view as important in classroom performance. In addition the PM-NM tasks offer the practical advantage of quick, easy, and inexpensive administration.

The value of the sustained attention task, the CPT, requires reconsideration. One notable shortcoming of the CPT is the absence of a standardized format and administrative procedure. Should this task continue to be used, standardization is essential to clarify the interpretability of results within and between studies. A further drawback to the CPT is the tedious and monotonous nature of the task itself. In the author's opinion, the CPT was an unpleasant experience for both the subjects and the experimenter. In light of the aforementioned limitations and the difficulties encountered in attempting to pinpoint the source of the negative findings involving this task, it is suggested that the CPT be abandoned as a test instrument.

Suggestions for Further Research

On the basis of the results of the present research project it is recommended that further research be conducted in the areas of rating scales of ADHD and person-based tasks in the assessment of attention deficits.

The rating scales used in this research indicate that three dimensions of behavior are relevant to the assessment of ADHD, those being attention, hyperactivity-impulsivity, and temperament. Currently, a large number of rating scales are available for the assessment of ADHD. However, no one scale is available that combines the three dimensions identified in this research. Most particularly absent are items dealing with the temperamental aspects of ADHD behavior. Of interest would be the development of one rating scale that is balanced in its treatment of each dimension. This could be accomplished by developing a scale with an equal sampling of items from each domain or through the weighting of the factors. Clearly, more items on temperament would be desirable to form a more complete picture of the association between this factor and the ADHD syndrome.

The findings of this project point to evidence that attention tasks that demand attention to be fully focused and controlled, such as the Physical Match-Name Match tasks employed here, may be sensitive, discriminating tests of attention deficits. At this time, there is no single, person-based diagnostic test for attention deficits and the need for such an instrument is recognized (Ross & Ross, 1982). It is recommended that research be undertaken to further study the efficacy of the PM-NM tasks in assessing attention deficits.

The current research project studied the ACRS and its adequacy in assessing attention deficits in the mildly mentally handicapped. Future research is needed with non-retarded samples of ADHD children to verify the range of applicability of the results of this research.

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APPENDIX A

Abbreviated Conners Rating Scale (Conners, 1973)

Note. Copyright permission not required.

Appendix A

Abbreviated Conners Rating Scale (Conners, 1973)

Child's Name _____

Teacher's Observation

Information obtained _____ By _____

Month Day Year

Listed below are descriptive terms of behavior. Place a check mark in the column which best describes this child. ANSWER ALL ITEMS.

	Degree of Activity			
	Not at all	Just a little	Pretty Much	Very Much
Observation	0	1	2	3
1. Restless or overactive				
2. Excitable, impulsive				
3. Disturbs other children				
4. Fails to finish things he starts, short attention span				
5. Constantly fidgeting				
6. Inattentive, easily distracted				
7. Demands must be met immediately, easily frustrated				
8. Cries often and easily				
9. Mood changes quickly and drastically				
10. Temper outbursts, explosive and unpredictable behavior				

APPENDIX B

Attention Checklist and Key (Das, 1986b)

Note. From Attention-Activation Questionnaire by J. P. Das 1986, unpublished instrument. Adapted by permission.

Appendix B

Attention Checklist (Das, 1986b)

Child's Name _____

Information obtained _____ By _____
Month Day Year

Listed below are questions about the child's behavior. Place a check mark in the column which best describes this child. ANSWER ALL ITEMS.

	Not at all	Just a little	Pretty Much	Very Much
1. Does the child have a short attention span?				
2. Does the child appear detached from class activities?				
3. Does the child accurately heed directions?				
4. Does the child daydream in class?				
5. Does the child have trouble concentrating?				
6. Does the child stay with one activity long enough to complete it?				
7. Does the child work independently?				
8. Is the child easily distracted?				
9. Is the child able to concentrate on a task until completed?				
10. Does the child listen attentively?				
11. Does the child become easily engrossed in an activity?				
12. Does the child disregard some or all directions?				

Attention Checklist (Key)

Child's Name _____

Information obtained _____ By _____
Month Day Year

Listed below are questions about the child's behavior. Place a check mark in the column which best describes this child. ANSWER ALL ITEMS.

	Not at all	Just a little	Pretty Much	Very Much
1. Does the child have a short attention span?	4	3	2	1
2. Does the child appear detached from class activities?	4	3	2	1
3. Does the child accurately heed directions?	1	2	3	4
4. Does the child daydream in class?	4	3	2	1
5. Does the child have trouble concentrating?	4	3	2	1
6. Does the child stay with one activity long enough to complete it?	1	2	3	4
7. Does the child work independently?	1	2	3	4
8. Is the child easily distracted?	4	3	2	1
9. Is the child able to concentrate on a task until completed?	1	2	3	4
10. Does the child listen attentively?	1	2	3	4
11. Does the child become easily engrossed in an activity?	1	2	3	4
12. Does the child disregard some or all directions?	4	3	2	1

APPENDIX C

Table C-1. Item Analysis and Hoyt Estimate of Reliability of Abbreviated Conners Rating Scale (N = 100)

Table C-2. Item Analysis and Hoyt Estimate of Reliability of Attention Checklist (N = 100)

Appendix C

Table C-1

Item Analysis and Hoyt Estimate of Reliability of Abbreviated Conners Rating Scale (N = 100)

Item #	Rating (%)				r_{TT}
	0	1	2	3	
1	29	35	21	15	.88
2	28	31	22	19	.87
3	35	32	15	18	.87
4	25	43	15	17	.71
5	34	33	17	16	.85
6	21	42	18	19	.87
7	43	24	17	16	.86
8	79	13	4	4	.48
9	50	22	15	13	.84
10	56	17	14	13	.84

Reliability of ACRS = .94

SE_{msmt} = 1.92

Table C-2

Item Analysis and Hoyt Estimate of Reliability of Attention Checklist (N = 100)

Item #	Rating (%) 1	2	3	4	r_{TT}
1	16	17	45	22	.90
2	14	12	46	28	.75
3	9	26	46	19	.72
4	10	12	42	36	.73
5	21	17	44	18	.89
6	7	24	47	22	.87
7	14	16	39	31	.81
8	22	20	48	10	.86
9	8	23	46	23	.87
10	11	27	46	16	.90
11	13	26	41	20	.85
12	11	15	45	29	.84

Reliability of ACL = .96
SE_{msmt} = 1.81

APPENDIX D

Table D-1. Factor Analysis - Combined ACRS and ACL Principal Component with Oblique Rotation (N = 100)

Table D-2. Factor Correlation Matrix of Factor Analysis - Combined ACRS and ACL Principal Component with Oblique Rotation (N = 100)

Appendix D

Table D-1

Factor Analysis - Combined ACRS and ACL Principal Component with Oblique Rotation (N = 100)

Item #1		Factor 1 (Attention)	Factor 2 (Hyperactivity-Impulsivity)	Factor 3 (Temperament)
ACRS	1	.08	.99*	.04
	2	.01	.80*	.25
	3	-.06	.86*	.02
	4	-.95*	-.04	-.04
	5	-.20	.83*	-.17
	6	-.40	.62*	-.08
	7	-.20	.55*	.36
	8	-.07	-.04	.86*
	9	-.13	.43	.61*
	10	-.11	.48	.56*
ACL	1	.68*	-.31	-.01
	2	.77*	.04	-.04
	3	.68*	-.14	.15
	4	.77*	.11	-.12
	5	.74*	-.27	.14
	6	.97*	.17	-.11
	7	.79*	-.07	-.11
	8	.45	-.52*	-.09
	9	.91*	.07	-.10
	10	.74*	-.23	.01
	11	.84*	-.05	.03
	12	.60*	-.35	.08
Eigenvalues		13.97	1.75	1.33
Percent Variance		63.50	8.00	6.00

*Loadings above .50 have been marked.

Table D-2

Factor Correlation Matrix of Factor Analysis - Combined ACRS and ACL Principal Component with Oblique Rotation (N = 100)

	Factor 1 (Attention)	Factor 2 (Hyperactivity-Impulsivity)	Factor 3 (Temperament)
Factor 1	1.00		
Factor 2	- .64	1.00	
Factor 3	- .32	.27	1.00

APPENDIX E

Sustained Attention Task

Appendix E

Sustained Attention Task

Task Description

This attention task requires that the child listen to a tape recording of a list of names. Four boys' names (Doug, Paul, Dave and Pete) and four girls' names (Jane, Liz, Sue, and Ann) are presented using a tape recorder. The names are presented at the rate of one every second over a ten minute interval. Three signals occur each minute. The child is required to tell the examiner when the signal was presented (in this case the name Pete followed by the name Liz). The child is instructed to tell the examiner when the signals occurred by tapping his or her hand loudly on the table.

Administration Guidelines

1. Administer the task using the tape recorder.

2. Examiners must keep track of the names presented by writing a check mark on the record form next to each word presented. Additionally, circle the pairs of words which the child designates as a signal.

3. Examiners must be sure to circle ALL the word pairs indicated by the child as a signal. That is, the correct and incorrect responses.

4. Examiners must also be sure that the testing environment is appropriately quiet during this task.

Directions for Administration

Examiner says: "You're going to listen to boys' and girls' names. The boys' names are Pete, Doug, Paul and Dave (pause) and the girls' names are Liz, Jane, Sue and Ann. These names will be said one after the other for several minutes. You are to listen and tap your hand on the table gently like this (examiner demonstrates), when you hear the name Pete followed by Liz. I'm going to play this tape of names. Listen carefully and tap your hand loudly on the table when you hear, Pete Liz. This will be only for practice. Are you ready?" Provide any explanation needed.

After the practice trial has been completed, the examiner says: "Now I'm going to play the tape again. Listen carefully and tap your hand loudly on the table when you hear Pete Liz. Keep listening until I tell you to stop. It will take a while so just keep going, I'll tell you when we're finished. Are you ready?" Provide any brief explanation needed. "Here we go." At the end of the tape provide some positive statement such as "You did very well".

Sustained Attention Task

Put a check next to each word as it is presented, circle all those word pairs indicated by the subject as targets. DO NOT stop the tape before ten minutes.

Practice Trial.

Jane__ Liz__ Jane__ Sue__ Dave__ Sue__ Ann__ Liz__ Pete__ Liz__Jane __

Doug__ Dave__ Doug__ Pete__ Liz__ Dave__ Ann__ Doug__ Paul__ Pete__

Doug__ Paul__ Ann__ Ann__ Dave__ Pete__ Liz__ Pete__ Dave__

Minute 1: Number Correct = _____.

Doug__ Paul__ Paul__ Pete__ Jane__ Ann__ Sue__ Doug__

Pete__ Liz__ Ann__ Jane__ Jane__ Doug__ Jane__ Paul__ Doug__ Jane__

Doug__ Jane__ Ann__Dave__ Sue__ Paul__ Pete__ Liz__ Sue__ Pete__

Jane__ Jane__ Liz__ Ann__ Paul__ Doug__ Ann__ Jane__ Liz__ Paul__ Ann__

Liz__ Paul__ Doug__ Pete__ Jane__ Liz__ Liz__ Pete__ Liz__ Doug__

Doug__ Liz__ Sue__ Sue__ Pete__ Jane__ Sue__ Jane__ Liz__ Pete__ Doug__

Minute 2: Number Correct = _____.

Dave__ Paul__ Jane__ Pete__ Paul__ Dave__ Ann__ Dave__ Paul__ Doug__

Dave__ Ann__ Liz__ Dave__ Jane__ Paul__ Liz__ Ann__ Pete__ Liz__ Sue__

Jane__ Sue__ Jane__ Dave__ Ann__ Sue__ Pete__ Liz__ Paul__ Liz__

Ann__ Paul__ Pete__ Paul__ Jane__ Sue__ Pete__ Liz__ Doug__ Paul__

Doug__ Jane__ Sue__ Doug__ Jane__ Sue__ Ann__ Doug__ Paul__

Examiner comments:

Minute 3: Number Correct = _____.

Sue__ Ann__ Paul__ Pete__ Doug__ Ann__ Jane__ Ann__

Pete__ Liz__ Dave__ Sue__ Jane__ Ann__ Jane__ Jane__ Liz__ Sue__

Jane__ Doug__ Dave__ Jane__ Sue__ Paul__ Pete__ Doug__ Pete__ Dave__

Sue__ Sue__ Liz__ Dave__ Ann__ Liz__ Sue__ Liz__ Sue__ Pete__ Dave__

Paul__ Sue__ Liz__ Doug__ Doug__ Paul__ Sue__ Jane__ Dave__ Paul__

Liz__ Dave__ Pete__ Liz__ Sue__ Sue__ Liz__ Paul__ Paul__ Ann__ Liz__

Minute 4: Number Correct = _____.

Doug__ Pete__ Liz__ Dave__ Dave__ Pete__ Dave__ Doug__ Liz__ Sue__

Paul__ Dave__ Doug__ Jane__ Doug__ Dave__ Doug__ Paul__ Liz__ Ann__

Jane__ Jane__ Paul__ Doug__ Liz__ Jane__ Liz__ Jane__ Sue__ Sue__

Pete__ Liz__ Sue__ Doug__ Doug__ Ann__ Jane__ Dave__ Pete__ Jane__

Liz__ Dave__ Sue__ Jane__ Liz__ Jane__ Sue__ Jane__ Paul__ Doug__

Sue__ Sue__ Pete__ Liz__ Dave__ Dave__ Liz__ Pete__ Doug__ Doug__

Minute 5: Number Correct = _____.

Paul__ Ann__ Jane__ Paul__ Jane__ Ann__ Liz__ Sue__ Ann__

Jane__ Jane__ Pete__ Liz__ Doug__ Ann__ Sue__ Sue__ Liz__ Doug__

Jane__ Ann__ Sue__ Doug__ Paul__ Jane__ Sue__ Paul__ Sue__ Liz__

Pete__ Liz__ Dave__ Ann__ Ann__ Paul__ Ann__ Doug__ Pete__ Liz__

Doug__ Ann__ Ann__ Dave__ Pete__ Dave__ Doug__ Dave__ Doug__ Jane__

Ann__ Liz__ Paul__ Ann__ Jane__ Sue__ Dave__ Sue__ Jane__ Liz__

Jane__

Examiner comments:

Minute 6: Number Correct = _____.

Sue__ Ann__ Paul__ Pete__ Doug__ Ann__ Jane__ Ann__

Pete__ Liz__ Dave__ Sue__ Jane__ Jane__ Liz__ Sue__

Jane__ Doug__ Dave__ Paul__ Liz__ Paul__ Pete__ Doug__ Liz__ Pete__

Sue__ Sue__ Liz__ Dave__ Ann__ Liz__ Sue__ Liz__ Sue__ Pete__ Liz__

Paul__ Sue__ Liz__ Doug__ Doug__ Paul__ Sue__ Jane__ Dave__ Paul__

Liz__ Dave__ Paul__ Pete__ Sue__ Sue__ Liz__ Paul__ Paul__ Pete__ Liz__

Minute 7: Number Correct = _____.

Doug__ Paul__ Paul__ Pete__ Liz__ Ann__ Sue__ Doug__

Liz__ Dave__ Ann__ Jane__ Jane__ Doug__ Jane__ Paul__ Doug__ Jane__

Pete__ Liz__ Ann__ Dave__ Sue__ Paul__ Pete__ Jane__ Sue__ Pete__

Jane__ Jane__ Liz__ Ann__ Paul__ Pete__ Liz__ Jane__ Liz__ Paul__ Ann__

Liz__ Paul__ Doug__ Pete__ Jane__ Liz__ Liz__ Pete__ Doug__ Doug__

Doug__ Liz__ Sue__ Sue__ Pete__ Jane__ Sue__ Jane__ Liz__ Pete__ Doug__

Minute 8: Number Correct = _____.

Paul__ Ann__ Jane__ Paul__ Jane__ Ann__ Liz__ Sue__ Ann__

Jane__ Jane__ Pete__ Liz__ Doug__ Ann__ Sue__ Sue__ Liz__ Doug__

Jane__ Ann__ Sue__ Paul__ Liz__ Jane__ Sue__ Paul__ Sue__ Liz__

Pete__ Liz__ Dave__ Ann__ Ann__ Paul__ Ann__ Doug__ Pete__ Jane__

Doug__ Ann__ Ann__ Dave__ Pete__ Liz__ Doug__ Dave__ Doug__ Jane__

Ann__ Liz__ Sue__ Ann__ Jane__ Sue__ Dave__ Sue__ Jane__ Liz__

Jane__

Examiner comments:

Minute 9: Number Correct = _____.

Doug__ Paul__ Liz__ Dave__ Dave__ Pete__ Dave__ Doug__ Liz__ Sue__

Paul__ Dave__ Pete__ Liz__ Doug__ Dave__ Doug__ Paul__ Liz__ Ann__

Jane__ Jane__ Paul__ Doug__ Liz__ Jane__ Liz__ Jane__ Sue__ Sue__

Pete__ Dave__ Sue__ Doug__ Doug__ Ann__ Jane__ Dave__ Pete__ Jane__

Liz__ Doug__ Sue__ Jane__ Liz__ Jane__ Sue__ Jane__ Paul__ Doug__

Sue__ Sue__ Pete__ Liz__ Dave__ Dave__ Pete__ Liz__ Doug__ Doug__

Minute 10: Number Correct = _____.

Dave__ Paul__ Jane__ Pete__ Paul__ Liz__ Jane__ Dave__ Paul__ Doug__

Dave__ Ann__ Liz__ Dave__ Jane__ Paul__ Liz__ Ann__ Pete__ Liz__ Sue__

Jane__ Sue__ Jane__ Dave__ Ann__ Sue__ Liz__ Pete__ Paul__ Liz__

Ann__ Doug__ Doug__ Doug__ Dave__ Jane__ Sue__ Doug__ Doug__ Ann__

Ann__ Paul__ Pete__ Liz__ Jane__ Sue__ Pete__ Jane__ Doug__ Paul__

Doug__ Jane__ Sue__ Doug__ Jane__ Sue__ Pete__ Liz__ Paul__

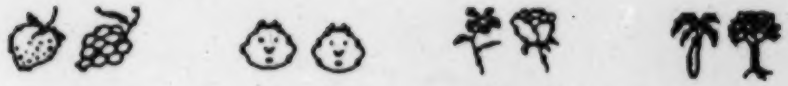
APPENDIX F

Selective Attention Task: Physical Match

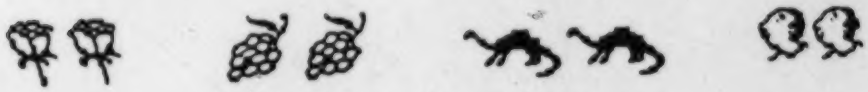
Appendix F

Selective Attention Task: Physical Match

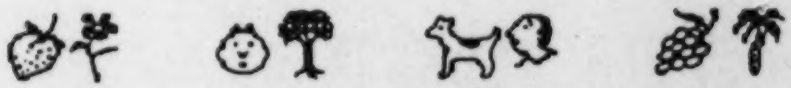
I am going to show you many pairs of pictures. The pictures are like this:



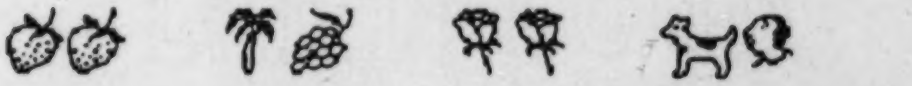
Some of the pairs are the same. They look the same. See these:



Some are not the same, they are different. Like these:

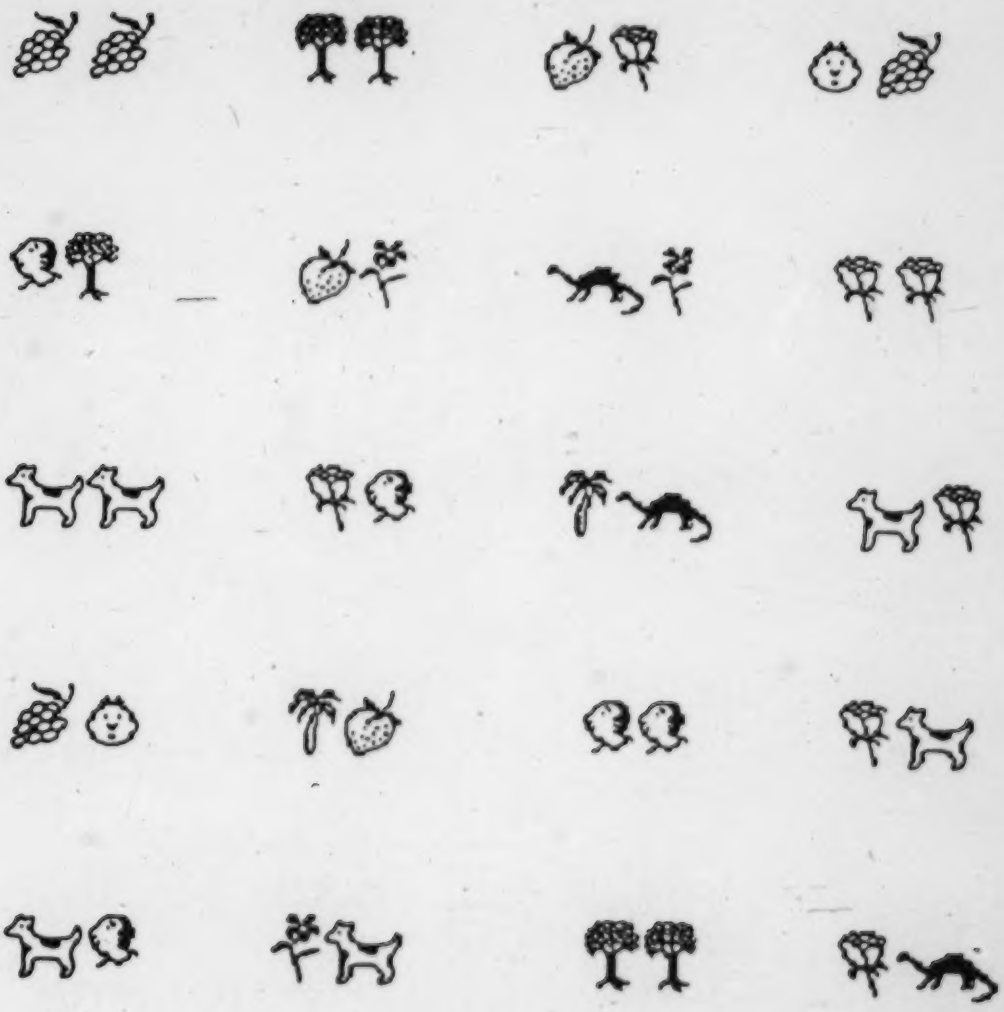


Circle the pairs that look the same.



<u>Practice</u>. Let's practice some more. Circle the picture pairs that look the same. Do it as fast as you can. Ready. Go.

Physical Match: Practice Trial



Physical Match: Task

APPENDIX G

Selective Attention Task: Name Match

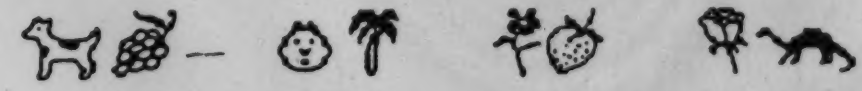
Appendix G

Selective Attention Task: Name Match

I am going to show you many pairs of pictures. The pictures are like this:

Some of the pairs have the same family name. Like these ones:

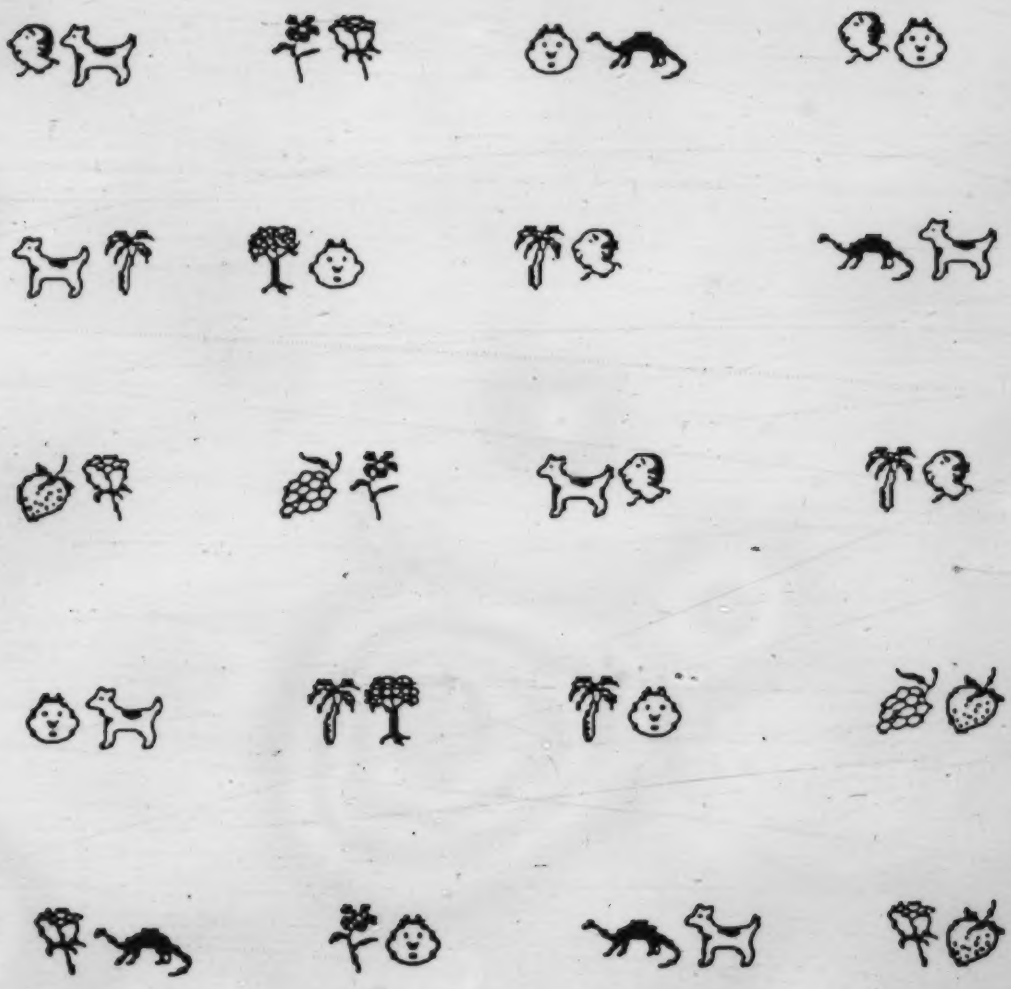
Some pairs do not have the same family name. Like these:



Circle the pairs that have the same family name.

<u>Practice</u>. Let's practice some more. Circle the picture pairs that have the same family name. Do it as fast as you can. Ready. Go.

Name Match: Practice Trial



Name Match: Task